(DRAFT)

ENVIRONMENTAL IMPACT REPORT

ON

SALES CREEK FLOOD CONTROL PROJECT

REVERE, MASSACHUSETTS

EOEA No. 01346

PREPARED FOR:

Massachusetts Department of

Environmental Quality Engineering

Division of Waterways

By:

CAMP DRESSER & McKEE Inc.

DRAFT SUBMITTED: 26 November 1976

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THOMAS F. CHEYER
Senior Vice President

November 26, 1976

Mr. David Standley, Commissioner
Commonwealth of Massachusetts
Executive Office of Environmental
Affairs
Department of Environmental Quality
Engineering
Division of Waterways
100 Cambridge Street
Boston, MA 02202

Draft Environmental Impact Report
Flood Control Works
Sales Creek, Revere
Your Reference: Contract No. 2850

Dear Commissioner Standley:

In accordance with our contract with the Division of Waterways, dated May 20, 1976 and received by us on July 28, 1976, we are submitting six copies of a draft environmental impact report for proposed flood control works for Sales Creek, Revere.

The draft is submitted in two volumes. Volume 1 contains a summary and the complete text of the report. Volume 2 contains appendices. It is our understanding that after a review by the Commonwealth and interested local agencies, a public hearing will be held with the Revere and Boston Conservation Commissions.

Twenty-five copies of the final environmental impact report will be submitted within 30 days after all comments on the draft report are received by us. This final report will include appropriate comments on the draft report and any clarifications or rewording of the text deemed necessary by us.

We wish to express our appreciation for the excellent cooperation we received from many state and local officials during preparation of this report, particularly from Mr. John Hannon, P.E., Chief Engineer from the Division of Waterways, and Messrs. George Sheehan and Edward McDonald of his staff. In addition, Mr. Andrew Christo, President of Andrew Cristo Engineers, Boston, Massachusetts, was very cooperative in providing us with

information from his 1974 Engineering Report on the proposed project. This report was prepared under the overall supervision of Mr. Thomas F. Cheyer, P.E. The project manager was Mr. William S. Howard, P.E., and Mr. Peter Barthuly, P.E. was the project engineer. Mr. James R. Woglom, P.E., our Director of Planning Services, provided valuable guidance. Jason Cortell Associates was a sub-consultant in the areas of biology and aquatic life.

Very truly yours,

CAMP DRESSER & McKEE Inc.

Thomas F. Cheyer

Thomas F. Cheyer

TFC/mbk

Enclosures

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SUMMARY

Attached is a draft Environmental Impact Report of proposed drainage improvements for Sales Creek, Revere and a portion of its tributary, Green's Creek. The proposed project is based upon an Engineering Report prepared in 1974 by Andrew Christo Engineers, Boston, Massachusetts. The estimated October 1977 cost of the project, including engineering and contingencies but not right-of-way easements, is $9,000,000. It is proposed to be funded and built under the sponsorship of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways.

The proposed major facilities consist of a pumping station at Bennington Street (at the point of Sales Creek discharge into Belle Isle Inlet), replacement and enlargement of most existing drainage culverts in the creeks, excavation of sediment and removal of debris from many of the existing drainage channels, and enclosement of two channel reaches of the creek in pipe conduits.

An estimated 700 homes and about 2000 people in the Sales Creek watershed are subject to periodic flooding. In addition, the Garfield Junior High School, Our Lady of Lourdes Church, and other public facilities, including Suffolk Downs (race track) also experience flooding.

At one time, Sales Creek drained to Chelsea Creek, but marshland filling operations in the past rerouted the creek to Belle Isle Inlet. Sales Creek at present is laden in places with debris caused by illegal dumping. Existing drainage culverts are in poor structural condition,

are heavily silted, and some have experienced substantial settlements. Channel sediment is degraded with large concentrations of oil and grease and heavy metals. Oil spills have been a problem in the past, both from a petroleum tank farm adjacent to Green's Creek and from tidal action on oil spills in Belle Isle Inlet.

Existing land use in the area is primarily recreational (Suffolk Downs), industrial (oil tank farm), dense residential, and undeveloped open space. No historical, archaeological, or paleontological sites were found in the watershed.

Elevations in the watershed vary from about 10-ft (BCB)[1] to about 135-ft (BCB) on top of Young's Hill and 165-ft (BCB) on top of Orient Heights. The majority of the watershed is at or below the elevation of 15-ft (BCB). Existing surficial soils are composed of marshland marine silt, muck and peat, filled land, drumlins and recessional morraine (formed by receding glaciers).

The biological environment of Sales Creek has no significant diversity and no significant wildlife or aquatic life present. Belle Isle Inlet, however, is very active biologically.

Sales Creek's water quality is classified B more by policy than investigation by the Division of Water Pollution Control, while the classification of Belle Isle Inlet is SB. The present condition of Sales Creek is worse than Class C (evidence of fecal coliform bacteria were found in water quality samples); the condition of the Belle Isle Inlet is generally SC. The most significant aquatic life in Belle Isle

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[1] BCB is the Boston City Base, an elevation datum 5.65 ft above the U.S. Geological Survey Mean Sea Level.

Inlet is an excellent stock of soft shell clams. Clam harvesting is forbidden in the Inlet by the Massachusetts Division of Marine Fisheries, however, because of bacterial contamination.

Significant beneficial impacts of the proposed flood control improvements include: (1) alleviation of flooding problems and damages; (2) better visual aesthetics of areas surrounding the creek following cleanup of past accumulation of trash; (3) reduction of unsanitary conditions due to the removal of rodent breeding areas; (4) increased water quality due to the reduction of possible combined sewer overflows, and illegally piped and/or inappropriate overland discharges to the creeks which may be rectified during final design and construction; and (5) an improvement to the image of the neighborhood and its property values resulting from the first four beneficial impacts.

There are no anticipated significant adverse impacts of the proposed project as long as proper mitigation measures are taken during final design, construction and subsequent operation to insure (1) increased water quality of the completed project resulting from elimination of any combined sewer overflows, any existing illegal piped connections, and any inappropriate overland flow; (2) that backfill and conduit materials are adequate to accommodate the ultimate land use above the completed project; (3) that contaminated excavation materials are not so placed and handled as to permit future water quality degradation; (4) that sufficient land in the form of rights-of-way or easements is obtained to permit adequate access to the completed project to allow continued maintenance; and (5) that proper public prevention and maintenance measures including grass cutting, bank clearing (as well as debris and sediment prevention)

and cleaning are carried out after project construction.

Further, unless adequate measures are taken during construction to minimize the amount of sediment and polluted water (resulting from a mixing of the sediment and water during excavation of the channels) entering the Belle Isle Inlet, potentially significant adverse impacts of the proposed project could occur during construction. A possible construction procedure using bulkheads and hay bales to control sediment discharge is discussed in the report. If these, or comparable, protective measures are taken, only minimal damage should occur. The potential impacts of concern would result from some heavy metals, oils and grease entering the Inlet and damaging some shellfish and benthic biota. Should such damage occur, it is not anticipated to be permanent and should affect only the upper third of the Inlet.

Another potentially significant adverse impact during construction is the disposal of sediment excavated from the channels, which contain large concentrations of oil and grease and heavy metals. A number of disposal alternatives were considered including ocean disposal, landfill disposal, diking, and site burial. Since there appears to be available and suitable land near the project site, on-site burial appears to be preferable. A 3 or 4 acre pit about 4-ft deep (allowing for a 1-ft cover) would appear to be the minimum required, depending upon the consolidation capabilities of the sediment. Preliminary sediment analyses indicate that, if the procedures outlined in this report are carried out, no significant adverse permanent impact should result from the indicated disposal technique. The technique assumes a certain cubic yardage of contaminated excavation material, based upon existing preliminary soil information. During the final design phase, borings and sediment analyses should be taken to substantiate the expected quantities of excavation.

If, as a result, a significantly larger amount of contaminated material is expected, additional land or off-site disposal would be needed. Alternatives requiring less excavation, such as the use of piles to support the installed conduits, could also be considered.

Of the several structural project alternatives considered, the only viable one was diverting Sales Creek drainage to the Chelsea River. The Chelsea River is classified as SC, while Belle Isle Inlet is classified SB. Hence, impacts during construction would likely be less problematic to the Chelsea River than to Sales Creek. On the other hand, it is estimated that the completed cost of this project alternative is about 20 percent more expensive than the proposed project. In addition, a detailed engineering study would be required to ensure project feasibility, select proper culvert sizes, routes, etc., thereby delaying the project and adding significantly to its comparative cost. Accordingly, this alternative is not recommended.

In accordance with state regulations, the "no build" and "defer action" alternatives were also considered. The serious flooding problems and poor structural condition of many of the existing culverts make the "no build" alternative unacceptable. Further, there are no known reasons or advantages for deferring the improvements. In addition, deferring the project will result in continued flooding conditions and increased structural deterioration of existing culverts.

In summary, the project outlined in the Engineering Report is recommended, provided that adequate measures are taken during design, construction, and operation to ensure that the maximum benefits are obtained and minimum damage is done to the environment.

I. PROPOSED PROJECT - GENERAL

A. Project Objective

The proposed project is to construct flood control improvements to Sales Creek and part of Green's Creek in Revere. Revere is a city encompassing about 5.95 square miles, located north of Boston and Winthrop, east of Chelsea, and south of Saugus and Lynn. It is bounded on the east by the Atlantic Ocean. Fig. 1, page I-2, is a general location plan of Revere and the project area.

The purpose of the proposed flood control improvements is to alleviate flooding along Sales Creek and its tributaries. Benefits to be realized by the project include improvement to the residential environment in flood-prone areas and aesthetic improvement to Sales Creek, resulting from cleanup of the voluminous amount of debris which currently clutters the creek and its banks.

> Field investigations have revealed that the critical problem areas are located north and east of the Revere Beach Parkway. The areas constantly flooded are the low lying areas of the Beachmont area east of the Parkway, the Standish Road, Eliot Road and Garfield School areas, and the areas contiguous thereto. The ground levels at these locations are close to the level of normal high tides and in some instances the ground levels are lower by as much as 2 feet.

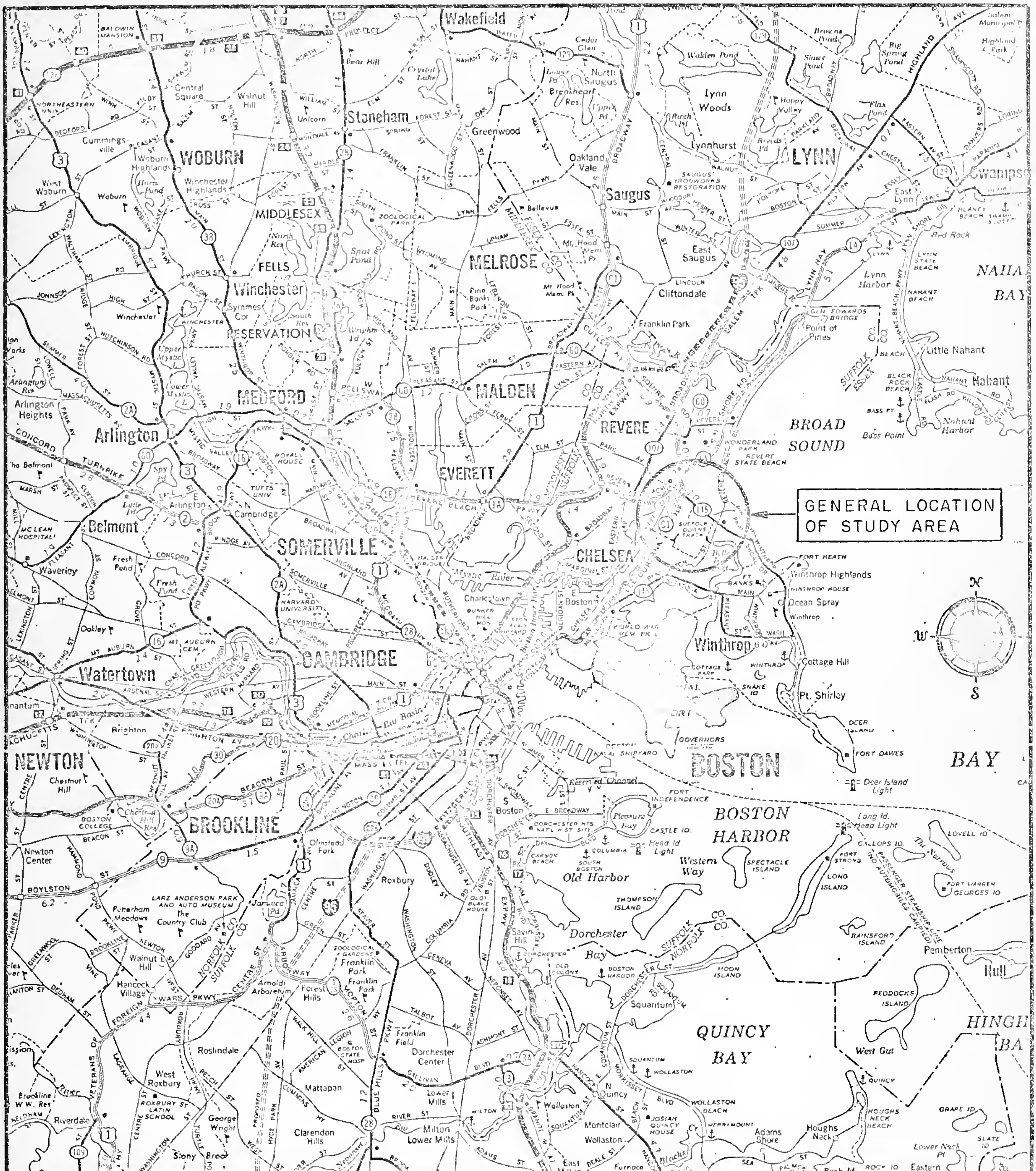

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FIG. I GENERAL LOCATION MAP

Field investigations have revealed that the existing conduit and channel system is in poor condition and in most cases does not have the hydraulic capacity to alleviate flooding in the problem areas.[1]

B. Scope of Project

The Sales Creek flood control improvements have been described and proposed in a previous engineering study by Andrew Christo Engineers,[2] hereinafter referred to as the Engineering Report. The major portion of the proposed improvements would occur on Sales Creek and its tributary, Green's Creek (Plate 1, appendix A from the Engineering Report). The length of waterway involved in the improvement project would be about 8,000 ft. (Fig. 2, page I-4, is a schematic diagram of proposed improvements). Improvements include construction of a floodwater pumping station at Bennington Street, various conduit improvements and replacements, and open channel modifications. For location and general description of the proposed improvements, see Plate No. 22 of the Engineering Report reproduced in appendix A of this report. As shown on this plate, proposed improvements are located by reaches (Reaches 1 through 5). These same reaches are used in this report.

Please note that the Bennington Street structural improvements recommended in the Engineering Report (pp 7-2) as follows have already been constructed:

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[1]Engineering Report, pp 1 to 4.

[2]Flood Control Study - Sales Creek, Revere - Andrew Christo Engineers, February 1974.

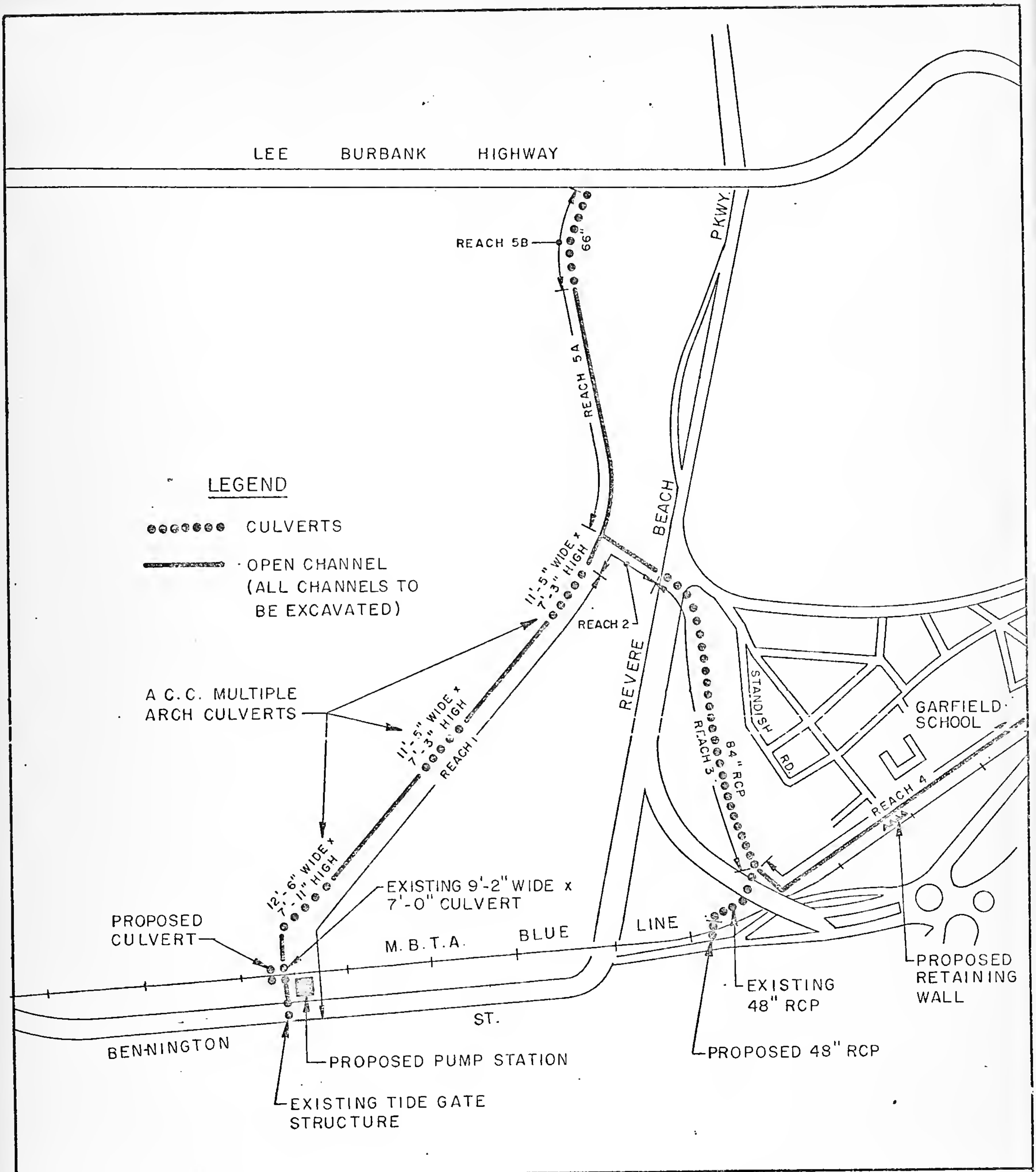

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FIG. 2 SCHEMATIC OF PROPOSED IMPROVEMENTS

Bennington Street Structure-Modify both sides of the existing structure to accommodate provisions for stop logs, construct a new and manageable trash rack on the tidal side of the structure, a new trash deflector on the west side, a new cut-off wall on the east side and install channel paving on both ends of the structure.

Also, by contract between the Commonwealth of Massachusetts and Camp Dresser & McKee, the Engineering Report recommendations for dredging Belle Isle Inlet are excluded.

No consideration was given in the Engineering Report to other alternative projects for the reduction or elimination of flooding in the watershed. In addition, no environmental or economic assessment of proposed improvements was contained in this report. Presumably, these items were not included in the scope of work for the Engineering Report. The estimated cost of these improvements is about $9,000,000[3] (a more detailed breakdown is presented later in this report). Most of the 552 acres of the watershed (Plate 1, appended) lies in the southeast portion of Revere with a small portion in East Boston.

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[3] Based on the Massachusetts Division of Waterways October 1975 costs projected to October 1977.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT RELEVANT TO PROPOSED PROJECT

A. The Physical Environment

1. Land Resources

a. Topography. Primarily as a result of man's activities over the years, the physical features of the land have been altered. The low lying tide marsh west of Bennington Street has been subjected to extensive filling in the past. The area at the present Suffolk Downs race track site was used as a city dump from the late nineteenth century until the 1930's, when the race track was constructed. The marshland was further reduced by construction of a petroleum tank farm and a trailer park near the intersection of Lee Burbank Highway and Revere Beach Parkway. As a result of these and other activities, it has been reported that as much as 80 percent of the previously existing flood storage area has been lost.

The portion of watershed containing Suffolk Downs, the petroleum tank farm, and the trailer park (bounded by Lee Burbank Highway, Bennington Street, Revere Beach Parkway, and Orient Heights) comprises a 200-acre

rather flat lowland area with an average elevation of approximately 15 ft Boston City Base (BCB)[1] (Plate 1).

The Beachmont area located on the extreme eastern part of the watershed consists of two different types of terrain. On the southern edge of this portion of the watershed, an elongated hill (drumlin) runs between Bennington Street and the ocean, reaching a height of approximately 105 ft. North of the ridge, the Beachmont area becomes relatively flat with elevations of about 10 to 15 ft with some terrain lower than normal high tides (11 ft).

To the northeast of the Revere Beach Parkway, the terrain is dominated by Young's Hill (drumlin) which reaches an elevation of 125 ft. The northern and western slopes of Young's Hill drain to Green's Creek, which, in turn, is tributary to Sales Creek.

Between Young's Hill and Beachmont, generally north of the Revere Beach Parkway, is the Garfield Jr. High School area at elevations of 10 to 15 ft, which drains southerly to a branch of Sales Creek.

b. Geology and Soils. The watershed, which lies in the northern portion of the Boston Basin, consists of marshes, recessional moraine,[2] and small patches of gravel and sand, which lie between drumlins (Fig. 3, page II-3). The elliptical shape of the drumlins is a result of

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[1]Elevations in the text of this report and the Engineering Report are based on city of Boston datum. However, Plate 1 and Fig. 2 are contour maps on a USGS base. To convert to U.S. Coast and Geodetic Survey datum, subtract 5.65 ft.

[2]An end moraine (accumulation of earth and stones carried and finally deposited by a glacier) formed during a temporary halt in the final retreat of a glacier.

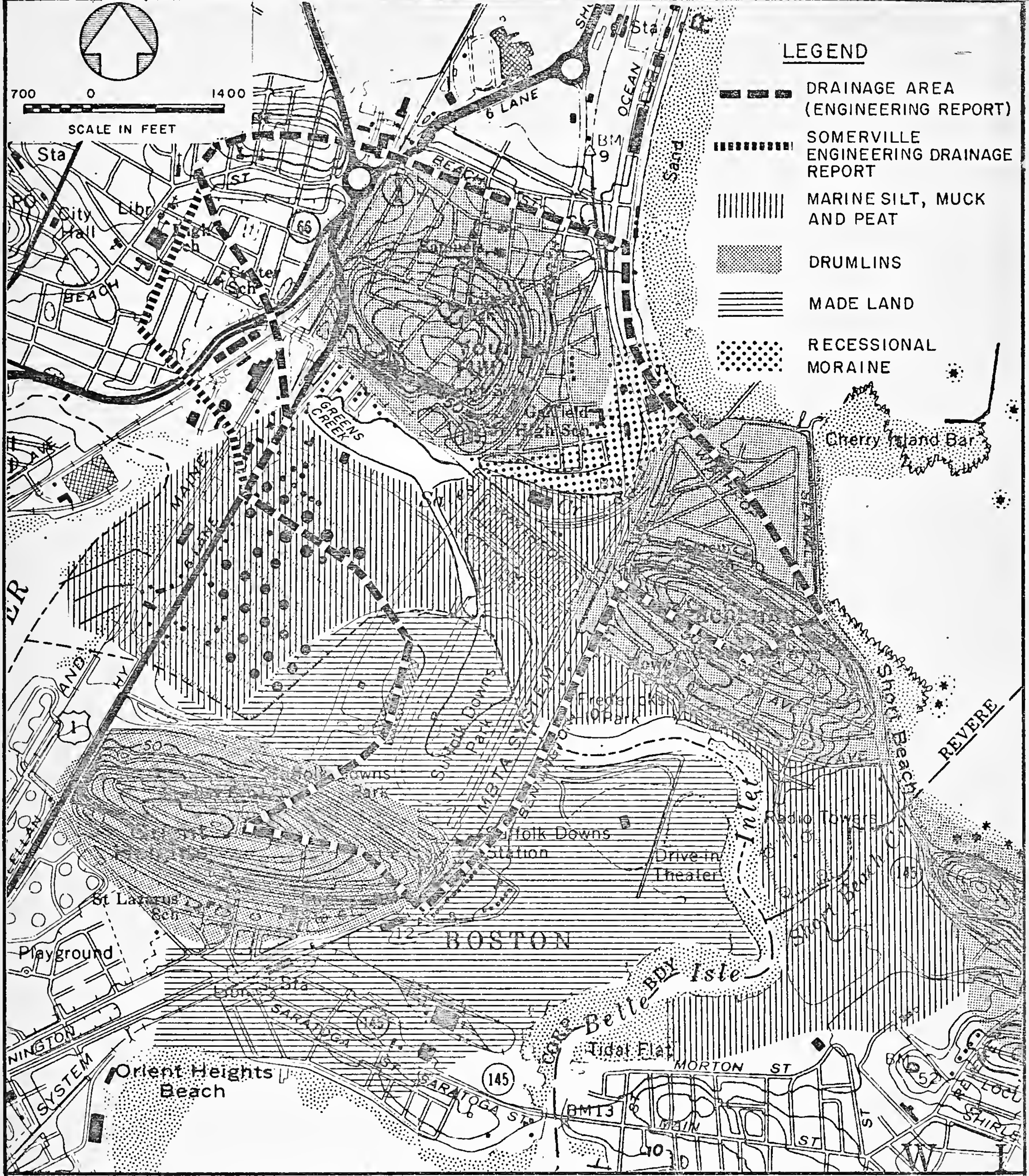

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FIG. 3 SOIL MAP

streamlining by glacial flow during the last Ice Age. The subsoil of these hills consists primarily of glacial till, underlain with a bedrock geology structure consisting of argillite, siliceous shale, slatey shale, slate, phyllite, and fine grained schist. These types of bedrock are indigenous to coastal areas immediately north and south of Boston, extending inland as far west as Watertown.

The ocean floor of Broad Sound (adjacent to the watershed) consists of thinly interbedded clay and fine sand, along with some thick layers of fine sand. These deposits are limited in their land distribution to low lying coastal areas such as the Sales Creek area, but are, for the most part, buried beneath younger outwash, salt marshes, and estuarine deposits.

A history of past filling and construction in the watershed was discussed in the Engineering Report and is presented below:

> The U.S. Geological Survey of 1885 through 1887 shows Belle Isle Inlet as a tidal estuary with outlets at both Saratoga Street into Boston Harbor to the south and Chelsea Creek to the west. In general, a major portion of the Sales Creek watershed was shown as a salt water marsh. The U.S. Geological Survey of 1889-1900 depicts this same feature. It should be noted that Sales Creek appeared to drain into Chelsea Creek more readily than Belle Isle Inlet. During this time interval, there had been gradual filling from Orient Heights in a northerly direction to the watercourse of Belle Isle Inlet. The 1889-1900 survey recognized this watercourse to be the City line which was established by statute.
>
> There were no changes in this general area until Lincense # 1400 was granted in April 1932 by the Massachusetts Department of Public Works. This license was issued to the Belle Isle Reclamation District for the purpose to 'build and maintain culverts, tide gates and drains and to fill Sales Creek, Green's Creek and Belle Isle Inlet in the Cities of Boston and Revere.' Subsequent to the issuance of License #1400, the Massachusetts Department of Public Works issued License #1417, 1491, and 1553, the latter being issued on December 26, 1934. The

work consisted of filling in Sales Creek and Belle Isle Inlet and constructing a new culvert with tide gates at Bennington Street and a new culvert under the Boston, Revere Beach, and Lynn Railroad (present MBTA Blue Line). Work also included construction of a dike across Sales Creek at a location west of Lee Burbank Highway and north of the existing tank farm and a tide gate on the westerly side of the tracks of the Boston & Maine RR, Eastern Division, at the former outlet of Sales Creek into Chelsea Creek. It should be noted that Lee Burbank Highway did not exist at the time. Work performed under these licenses effectively diverted discharges from Sales Creek and Green's Creek in an easterly direction through Belle Isle Inlet. The original open waterway connecting Sales Creek to Belle Isle Inlet is now partially enclosed with three culverts on race track property. License Plan #1491 issued on May 31, 1933, clearly identifies the change in the main drainage system of the Sales Creek watershed.

Subsequent to work performed by the Reclamation District, the race track was constructed. Research has not revealed any licenses or permits for constructing culverts through race track property. It should also be noted that there has been encroachment in approximately 800 ft of Green's Creek immediately to the east of Lee Burbank Highway since the time of issuance of said licenses to the present day. In 1933 this portion of Green's Creek was 100 ft in width; at the present time, the creek varies in width between 4 and 6 ft.

Of further interest is the fact that, prior to filling Sales Creek and Belle Isle Inlet, there was a tide gate on the south side of Revere Beach Parkway at the outlet of Sales Creek. This tide gate was removed at a later date.

As a result of this activity, much of the low lying land bounded by the Revere Beach Parkway and the Orient Heights area is composed of a surface layer of miscellaneous fill materials (resulting from past dumping and filling projects), including loose sand, gravel, boulders, ash, and cinders, all varying in depth. Underlying the fill are soft, brown peat and soft, gray organic silts, including some seashells at depths approximating the mean sea level plane. This layer varies to 20 ft in depth. Below this layer, some seams of coarse, gray or yellow sands occur, usually underlain by stiff, yellow, silty clay with occasional pockets of soft, blue clay.

Boring data, primarily from low lying areas in the Sales Creek Watershed, were obtained from several sources, including the USGS Geological Division, the Metropolitan District Commission (MDC), and Andrew Christo Engineers (Fig. 4, page II-7, appendix B).

Sand, gravel, and boulder layers varying in compactness and depth (5 to 30 ft) predominate in areas along Revere Beach Parkway, as indicated by MDC borings (appendix A).

Three borings (Fig. 4) performed by the USGS Geological Division along Lee Burbank Highway, indicate subsoils consisting of a mixture of sand, gravel, and clay. Borings from the Engineering Report in the Suffolk Downs area have indicated similar subsurface strata consisting of fill materials underlain by some silt. Coarse sand and gravel layers as thick as 30 ft and usually compacted are found beneath. A yellow clay layer usually underlies the sand and gravel. Intermixing of the clay and sand and gravel layers occurs at their interface.

Five USGS borings (Fig. 4) were also taken along the MBTA Blue Line tracks north of Sales Creek. The cover, as is typical in most of the Sales Creek area, consists of a layer of fill from past dumping and filling projects. Fresh water and estuarine peat, organic silt, sand, and minor gravel comprise the sublayer (from 5 to 20 ft thick). Underneath this layer occurs a thick layer of clay with some silt. Rock was found to underlie the clay in one of five borings along the tracks. A layer of sand and gravel indicated by one of the borings may have been formed from the Beachmont drumlin.

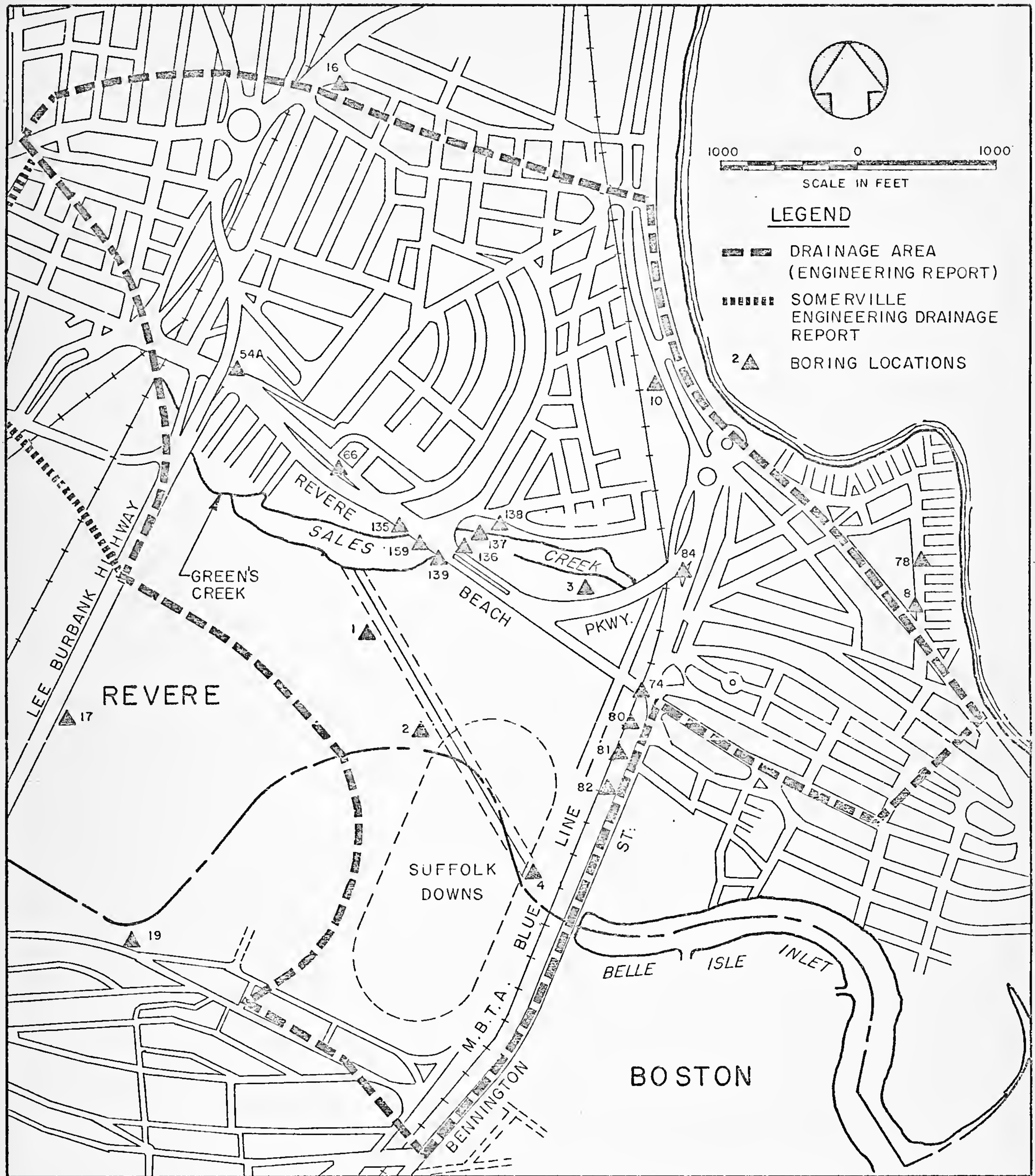

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FIG.4 BORING LOCATIONS

Two additional USGS borings along the coast indicated three types of soils: sand and gravel underlaid by a mixture of clay and sand and followed by a base layer of clay which contained some gravel and shell fragments. Erosion of the Beachmont drumlin is reported to be the probable source of these gravel deposits. One of the two borings indicated that rock was present at 43 ft below the surface.

2. Distinctive Features of the Watershed

a. Existing Land Use.[1] The existing land use characteristics (Fig. 5, page II-9), are based on the 1971 Land Use Map developed by William P. MacConnell (Massachusetts Department of Forestry and Wildlife Management) and field inspection. The Massachusetts Area Planning Council (MAPC) is currently updating land use characteristics, but the maps are not yet completed.

The majority of the land use north of Revere Beach Parkway and Winthrop Avenue consists of dense, urban residential areas (primarily single, two, and three family homes). Exceptions are: (1) transportation land use (terminal freight and storage facilities for railroad and truck freight) along the northern boundary of the watershed; (2) commercial land use (neighborhood business centers, strip commercial, gas stations, motels, and restaurants) along the northern boundary and beach area of the study area. The strip commercial land use along the beach area once was a

[1] Land use regulations are discussed under 4. Land Use and Land Use Controls in this section.

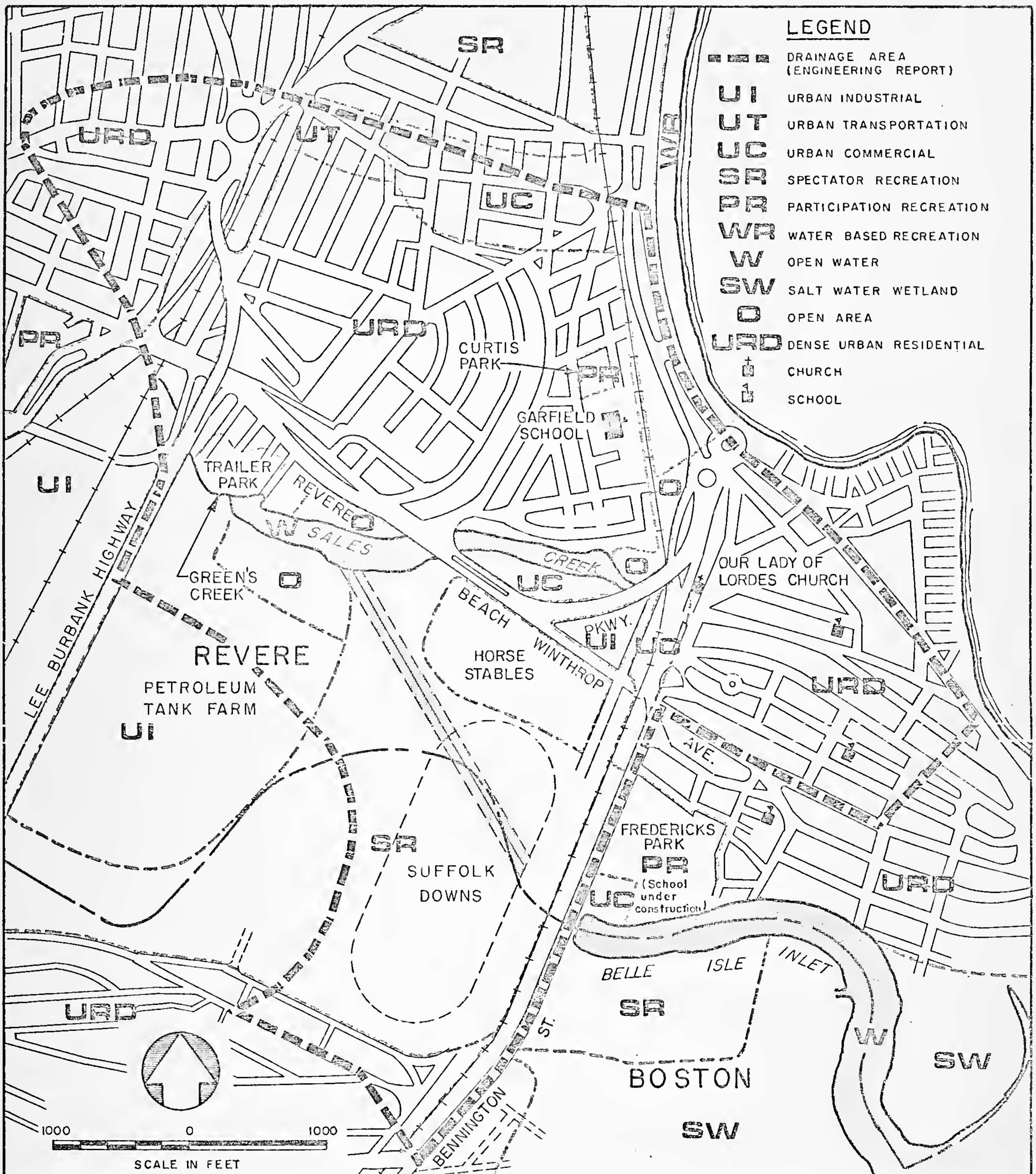

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FIG. 5 LAND USE PLAN

well-frequented amusement park (Revere Beach), but is currently being torn down with a few small stores and recreational game businesses remaining. Current plans call for two major commercial-housing developments along the beach area. Commercial land use areas also occur on land just west of Beachmont and on land just north of Revere Beach Parkway (a major supermarket complex, Cerratani's); (3) Curtis Park (recreational); and (4) open spaces occur along the MBTA Blue Line, just west of Beachmont.

The majority of the land use south of Revere Beach Parkway and Winthrop Avenue consists of an urban industrial area (petroleum tank farms) and a spectator recreational area (Suffolk Downs race track with adjacent parking lots and horse stable area). Exceptions are: (1) dense, urban, residential land use just north of Green's Creek which includes a trailer park, a recently constructed apartment complex, and houses and tenements; (2) the area bounded by Revere Beach Parkway and Sales Creek is classified as open space; however, it is owned by the Metropolitan District Commission (MDC) and is currently used by this agency as a dumping location for street sweepings and rubble; and (3) the area just south of Sales Creek is classified open space and is owned by the proprietors of Suffolk Downs.

Land uses adjacent to Belle Isle Inlet consist of a new elementary school currently under construction, a VFW post (UC), a dense urban residential area, and a spectator recreation area (SR). The spectator recreation area was once the site of a drive-in theater; however, the MDC is currently planning to construct a recreational park on this site. The remaining land is salt water wetlands.

3. Hydrology

Sales Creek and its tributaries are part of a coastal drainage area, having rather flat stream slopes which result in sluggish movement of water through the watershed. Being part of a coastal watershed, the ocean tides play a very important role in the hydrology of the area, with high tides equal to or higher than the elevation of some areas of the watershed.

Sales Creek formerly drained into the Chelsea River as well as Belle Isle Inlet. Over the years, the waterway areas, especially in the present Lee Burbank Highway section, were gradually reduced by dumping and filling activities. Today, the entire Sales Creek watershed drains into Belle Isle Inlet. As noted earlier, these past filling operations have caused severe reductions in the storage capacity of the watershed, resulting in increased stormwater flooding. Past storms have frequently affected approximately 500 dwelling units (about 1,400 people), particularly in the Beachmont and Standish Road areas (Fig. 6, page II-12). The Garfield School, Lady of Lourdes Church, Suffolk Downs, and MBTA Blue Line have all been affected by the floods. Fig. 6 also shows the preliminary delineation of the 100-year flood boundary established by the Federal Insurance Administration (FIA) (the flood boundaries which may occur during a storm having the statistical probability of occurring once every 100 years). A study to determine a more accurate 100-year boundary is scheduled by the FIA for 1977.

Runoff from the 552-acre watershed flows over residential areas in the upstream reaches of Sales Creek, while runoff in the downstream reaches of Sales Creek flows over the petroleum tank farm, Suffolk Downs, and mostly

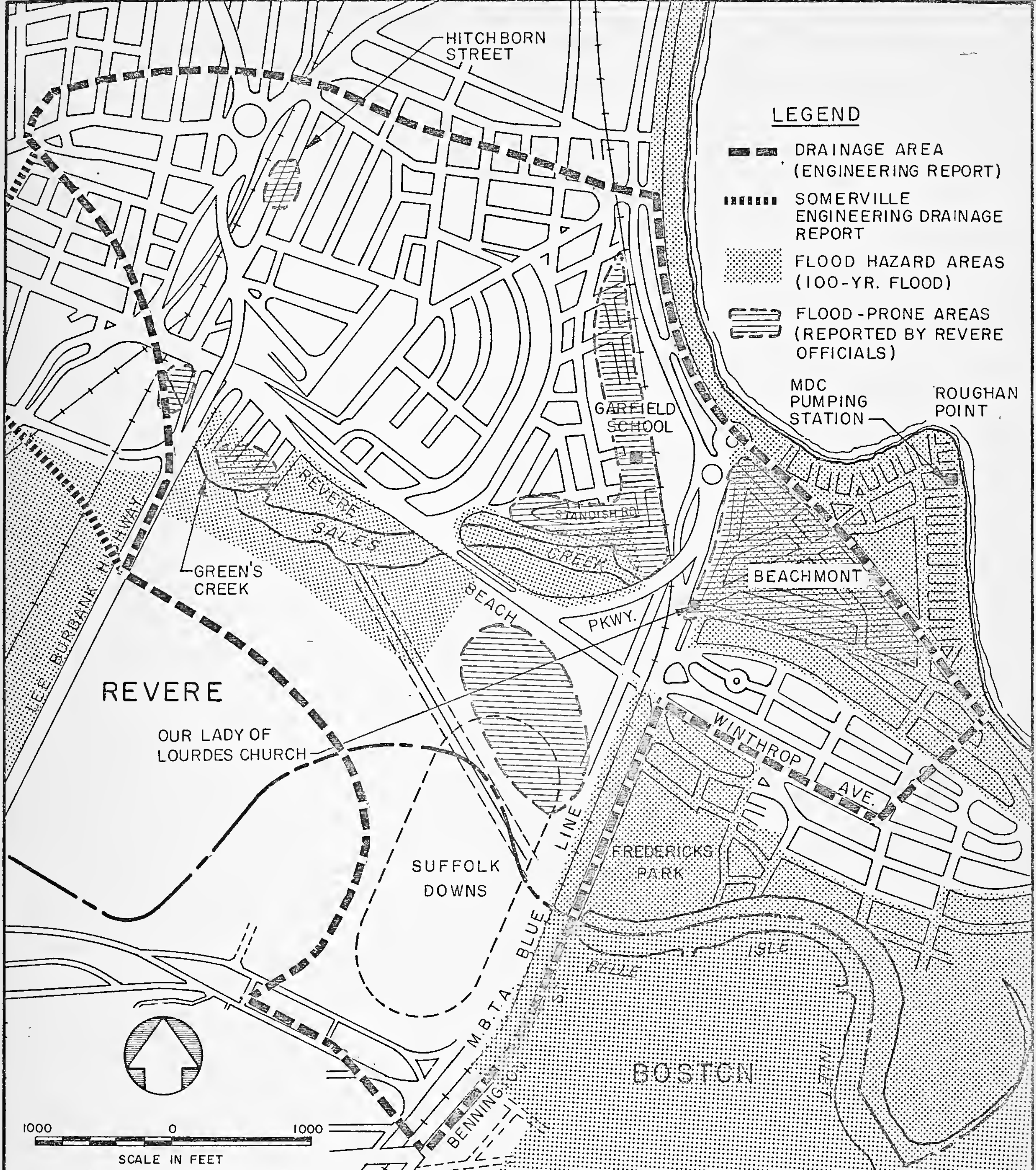

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FIG. 6 AREAS REPORTED TO BE SUBJECTED TO FLOODING

open spaces. Upper portions of the watershed would tend to retain more rainfall in the form of runoff because of impervious asphalt roads, parking lots, and concrete sidewalks, while lower portions of the watershed (basically open spaces) would retain less rainfall in the form of runoff.

The Engineering Report estimated the time of concentration (i.e., the time it takes for water from the furthermost upstream reaches of the drainage area to reach the outlet) to be about 1 hour. This time is usually related to the storm period which would cause the greatest storm flow in the creek. However, the necessary operation of Bennington Street tidal gates at the project outlet causes the stream system to act like a storage basin during high tide occurrences. Accordingly, the project design must not only be concerned with peak flow but also with the maximum volume of water required to be stored. The design storm used in the Engineering Report was a 6-hour, 25-year storm (i.e., a 6-hour storm which has the probability of occurring once every 25 years), because the storage period from the duration of high tides could last 6 hours. The project 25-year frequency is probably higher than the storm for which existing local drains were designed (generally a 5- to 10-year frequency). Peak flow associated with the proposed design was estimated in the Engineering Report to be 330 cfs, while the volume of water associated with the design storm was estimated to be about 3 million cu ft.

The highest tides can approach elevation 14.3 ft, while normal spring high tides are about 11 ft. The worst high tide recorded was 15.8 ft in 1851, and a more recent storm (29 December 1959) produced a high tide of 15.4 ft.

Both were higher than the Bennington Street roadway (elevation 14.8 ft). The shallow depth and sheltered aspect of Belle Isle Inlet would produce no significant wave runup problems during tides lower than the Bennington Street roadway. Flooding of Frederick's Park (just downstream of Bennington, outside of the study area) on Belle Isle Inlet may be a result of the inadequate drainage system further adversely affected by high tides and rainfall.

4. Description of Existing Facilities

a. Sales Creek. The existing channel and conduit system are shown on Plate 2, appended (from the Engineering Report). The Bennington Street outlet structure consists of a 9-ft 0-in. wide by 7-ft 2-in. high conduit which is 90 ft long and an 11-ft wide by 7-ft 2-in. high by 14-ft long chamber at the outlet side containing two tide gates. Tide gates are each 4-ft 6-in. wide by 7-ft 6-in. high (clear openings are each 4-ft 0-in. by 7-ft 0-in.). As noted in Chapter I, a trash rack on the tidal side, a trash deflector on the west side, a new cutoff wall on the east side, and channel paving has been constructed (based on Engineering Report recommendations).

The remainder of the existing system will be described by reaches (Plate 2, appended):

Reach 1

a. The 100-ft long by 50-ft wide open channel between the MBTA Blue Line tracks and the Bennington Street outlet structure

is weedy and strewn with debris, both of which tend to constrict the flow pattern of the stream.

b. The 46-ft long culvert under the MBTA Blue Line tracks is 9-ft 2-in. wide by 7-ft 0-in. high. The reinforced concrete culvert is spalling, exposing reinforcing steel at the sidewalls.

c. The 182-ft long by 50-ft wide open channel between the Suffolk Downs racing oval outlet culvert and the MBTA culvert is weedy and heavily silted.

d. The 276-ft long by 108-in. diameter corrugated metal culvert at the Suffolk Downs racing oval outlet is in very poor condition from corrosion and differential settlement of up to 18 in. The invert of the culvert is heavily silted.

e. The 760-ft long by 40-ft wide open channel between the Suffolk Downs racing oval inlet and outlet culverts is also heavily silted and weedy.

f. The culvert at the Suffolk Downs racing oval inlet is about 351 ft long. The downstream portion of the culvert is a 96-in. corrugated metal pipe with a length of about 84 ft, and the upstream portion of the culvert is an 84-in. corrugated metal pipe with a length of about 267 ft. This culvert is also in very poor condition from corrosion and differential settlement. The culvert is also heavily silted.

g. The 559-ft long by 30-ft wide open channel between the Suffolk Downs entrance driveway culvert and the racing oval inlet culvert is heavily silted and weedy. The weed growth is so abundant that the stream is mostly obscured.

h. The 231-ft long by 96-in. diameter corrugated metal culvert under the Suffolk Downs entrance driveway is in very poor condition from corrosion and severe differential settlement which has occurred to such a degree that the culvert pipe has a severe adverse slope. The invert of the pipe increases by 21 in. along the direction of flow. The entrance to the culvert is heavily laden with debris.

Reach 2

The 635-ft channel along Reach 2 extends from the Suffolk Downs entrance driveway culvert to the Revere Beach Parkway culvert. The heavily silted and weedy channel bed has a heavy concentration of debris (logs, tires, shopping carriages, etc.).

There is very limited mapping of the drainage system in the Suffolk Downs area. However, the area was field inspected during this study, and limited mapping information reviewed. From these investigations, it is apparent that drainage from the Suffolk Downs racing oval, parking lot, and horse stable area is discharged to the creek at Reaches 1 and 2.

Reach 3

a. The 188-ft long 60-in. diameter reinforced concrete culvert under Revere Beach Parkway is partially blocked by silt.

b. The open channel between the Revere Beach Parkway culvert and the headwall at the easterly leg of the Revere Beach Parkway is about 50 ft wide (with wider portions up to 100 ft) by 1,340 ft long. The channel is heavily silted and weedy and laden with debris. The flood plain north of the channel is heavily residential and subjected to flooding.

c. Beachmont area drainage enters through a headwall at the upstream end of Reach 3. The pipe opening at the headwall appears to be heavily silted. The size of the pipe could not be definitely determined by visual observations, but observations at an upstream manhole indicate that it may be 48 in. The Beachmont area is reported to be drained by the above 48-in. reinforced concrete pipe which crosses under Parkway and Washburn Avenue; two parallel 24-in. reinforced concrete pipes which cross under MBTA Blue Line tracks; a 42-in. reinforced concrete pipe which crosses under Bennington Street; and a 36-in. by 42-in. reinforced concrete box culvert which is the main drainage conduit from the Beachmont area. The drainage system is heavily silted. The

Beachmont area, which is heavily residential, has been subjected to frequent flooding.

Reach 4

The 2,100-ft long narrow (15 to 20 ft) open channel flows into Reach 3 just downstream of the headwall at the upstream end of Reach 3. Weed growth along the ditch is extensive and the area around the ditch, including the Garfield School, is subjected to flooding.

Reach 5A

The 1,000-ft long open channel (varying in width from 60 to 140 ft) is tributary to Reach 2 and is heavily silted and weedy. This reach contains substantial storage potential for controlling floodwaters. Debris is strewn along the northerly bank. A small stream containing petroleum deposits drains the area adjacent to the oil and gasoline tank storage areas.

Reach 5B

The 836-ft, very narrow (4 ft), channel is referred to as Green's Creek and is heavily silted. The silt covers the 48-in. pipe culvert which flows under the Lee Burbank Highway and into Green's Creek. Abundant weed growth obscures the watercourse. Industrial buildings and a trailer park border the stream.

b. Other Areas Contributing to Sales Creek.

Roughan Point

According to the Engineering Report, the drainage from Roughan Point (Plate 1, appended) is limited to about 3 cfs because of the low capacity of the drainage pipes. The bulk of the floodwater (which is reportedly from waverun along the seawall) in Roughan Point would be pumped to the ocean by two 15-mgd pumps at the recently constructed MDC pumping station.

Orient Heights Subdrainage Area

The Orient Heights subdrainage area is about 47 acres. An open ditch (Plate 1, appended) serves the storm runoff needs of the area. Part of the ditch flows through a culvert which is comprised of a 26-in. cast iron pipe which increases to a 30-in. corrugated metal pipe. The 200-ft culvert (located under the race track entrance road situated west of Bennington Street) is silted to within a few inches of its crown. Discharge flows into a 1,400-ft long open ditch, which is heavily silted. The ditch flows in a northerly direction until it intercepts Sales Creek.

Areas Upstream of Green's Creek - West of Lee Burbank Highway (Outside of Engineering Report study area, but within Sales Creek drainage area)

A 48-in. pipe crosses under Lee Burbank Highway and discharges into Green's Creek. The pipe is nearly submerged by silt deposits. The area west of Lee Burbank Highway was not included in the Engineering

Report because of contractual agreements; however, a general discussion of the area is warranted. A drainage ditch about 400 ft long exists upstream of the Lee Burbank Highway crossing. This ditch and the surrounding area are strewn with trash and other debris. An underground conduit system serves the upstream areas. Blockage problems because of local constrictions have occurred in the drainage system.

c. Belle Isle Inlet. Because any dredging of Belle Isle Inlet (originally recommended in the Engineering Report) is not currently planned, the inlet is discussed only to the extent that it is affected by modifications in the Sales Creek area.

5. Description of Proposed Facilities

a. Sales Creek. As noted previously, modifications (based on the Engineering Report) to the Bennington Street (Plate 22, appended) outlet structure have been implemented. Improvements included: (1) modification of the structure so that stop logs can be inserted in case the tide gates are damaged, (2) construction of a trash rack on the tidal side of the structure, (3) construction of a new trash deflector on the inlet side, to prevent the tide gates from jamming with debris, (4) construction of a cut-off wall on the outlet side, to minimize seawater infiltration, and (5) channel paving on both ends of the structure.

The remaining proposed improvements (from the Engineering Report) are shown on Plate 2, appended, and tabulated by stage of construction (see Table 1, page II-21).

TABLE 1. PROPOSED IMPROVEMENTS[1]

Reach No.	Phase No.[2]	Description of Proposed Improvements
1	II[3]	Bennington Street - 300 cfs Pumping Station
	III (Part)[3]	MBTA Tracks - 60-in RC Culvert and Repair Existing Culvert
	IV	Improvements through Suffolk Downs (Proceeding Upstream)
		(a) 12-ft-6-in wide by 7-ft-11-in high A.C.C.[4] Multiplate Pipe Arch (galvanized)
		(b) Channel Excavation to Trapezoidal Cross Section with 15-ft wide Base and 3 Horizontal to 1 Vertical Side Slopes
		(c) 11-ft-5-in wide by 7-ft-3-in high A.C.C. Multiplate Pipe Arch (galvanized)
		(d) Channel Excavation to Trapezoidal Cross Section with 15-ft wide Base and 1 Horizontal to 1 Vertical Side Slopes
		(e) 11-ft-5-in wide by 7-ft-3-in high A.C.C. Multiplate Pipe Arch (galvanized)
2	V (Part)	Channel Excavation to Trapezoidal Cross Section with 15-ft wide Base and 2 Horizontal to 1 Vertical Side Slopes
3	III (Part)[3]	Revere Beach Parkway and Upstream Open Channel - 84-in RC Culvert
4	VI	Channel Excavation to Trapezoidal Cross Section with 2-ft wide Base and 2 Horizontal to 1 Vertical Side Slope (one side) and 2 1/2 Horizontal to 1 Vertical Side Slope (other side), Channel to be Riprapped. Also 400-ft of Retaining Wall along Channel
5A	V (Part)	Channel Excavation to Trapezoidal Cross Section with 5-ft wide Base and 3 Horizontal to 1 Vertical Side Slopes
5B	V (Part)	Green's Creek - 66-in RC Culvert
Beachmont	VII	MBTA Tracks - 48-in RC Culvert and Clean Existing Drainage Pipes

NOTES: [1]Engineering Report, plans shown on Plates 22 and 23 and profiles on Plates 24 through 28

[2]Division of Waterways

[3]Currently funded by Division of Waterways

[4]Asphalt Covered Corrugated

(Profiles and cross sections of proposed improvements are shown on Plates 24-28.)

b. <u>Belle Isle Inlet</u>. Dredging of the Belle Isle Inlet (originally proposed in the Engineering Report, but not currently part of the proposed project) would be advantageous in minimizing the spread (trapping) of silt in Sales Creek. The dredged inlet would serve as a "silt reservoir" which would lessen the rate of silt piling up at the Bennington Street outlet. If no dredging were to be done, silt from the watershed would be less likely to pass through the outlet structure, and a silt wedge would form, backing up into Sales Creek and requiring periodic excavation and access difficulties. Based on hydraulic considerations only, the proposed dredging of the inlet is not required, if appropriate maintenance operations are undertaken periodically, to keep waterway areas free of silt and debris. A discussion of the environmental effects of dredging Belle Isle Inlet would be beyond the scope of this report.

c. <u>Areas Upstream of Green's Creek</u>. The area west of Lee Burbank Highway (upstream of Green's Creek) was not investigated in the Engineering Report because of contractual agreements. Based on information provided by Revere's city engineer, it appears that this area has not experienced flooding problems except at some local areas from blockage of drainage pipes. Therefore, it is likely that the design capability of the system is adequate, especially after proposed improvements are constructed downstream in Green's and Sales Creeks. However, the open ditch upstream of Lee Burbank Highway (about 400 ft long) is currently cluttered with debris and also heavily silted. It should be cleaned and dredged of silt, and the upstream conduit system which drains into the ditch should also be cleaned. The 48-in. pipe which crosses under the Lee Burbank Highway was not investigated to determine its structural

integrity. Unless this system is cleaned and maintained in a fully operable condition, its design capacity cannot be reached, and flooding would continue in its service area.

d. Hydraulics. The hydraulics of the improvements proposed in the Engineering Report were investigated in a general manner. It appears that the proposed improvements are, with a few minor additions, adequate for coping with the design 6-hour, 25-year storm used in the report. According to the Engineering Report, pump controls would be based on the water level in Reach 2, just south of the Parkway. No mention was made concerning the control of the water level at the pump suction. During final design, a detailed investigation of pump suction water level control should be made, so that pump controls could be related to the pump suction level as well as the upstream level.

Although the hydraulics of the proposed improvements appear generally adequate, the culvert sizes resulting from final design, might be nominally larger. Also, as a result of final design investigations, local lowering of the proposed culvert inverts in Reach 1 might be necessary to gain more flow area and, therefore, less head losses.

The following comments are offered for their potential utility: The existence of a 48-in. pipe which crosses under the easterly leg of Revere Beach Parkway could not be definitely determined in the field; therefore, the existence of the pipe would have to be determined during design or construction. If pipe(s) with smaller hydraulic capacities than that of a 48-in. exist, they would have to be replaced with adequate piping. Some

of the drainage pipe sizes mentioned in the Engineering Report do not correspond to the sizes reported to us by Revere officials; therefore, pertinent drains from the Beachmont area should be checked during or prior to construction.

The proposed channels should be continually maintained, to prevent excessive weed growth. The channels would also have to be reexcavated periodically as the need arises, if there is a sufficient buildup of silt. In particular, the channels, culverts, and drainage pipes in Reaches 1, 2, and 3 are not sloped; therefore, silting of these facilities could be expected. It might be a problem, especially in the 1,500-ft long 84-in. pipe in Reach 3, because silt and other debris from the open channel in Reach 4 might settle within the pipe, or the Beachmont drainage system might contribute material such as sand used for winter driving protection. The expected velocities through the 84-in. pipe would be about 2 to 3 fps (the minimum recommended velocity to prevent siltation is about 2 fps) during maximum stormwater flows; therefore, periodic self-cleaning of the pipe cannot be guaranteed.

Provisions should be made to connect the adjacent area's storm drain system to the 84-in. culvert manholes. Under the design storm, it is estimated that the 84-in. pipe would be surcharged by about 0.5 to 1 ft, possibly causing local ponding around catch basins in the adjacent low lying areas. This ponding would probably occur anyway, because local drains were probably not designed for a 25-year storm. A range of excavation from 2 to 5 ft is anticipated in this channel. (However, deeper

excavation might be required to structurally sound material. If so, back-fill would be required to support the culvert.) Provisions should also be made to connect the Reach 5B existing storm drains to the proposed manholes and/or to construct new catch basins.

All local drains must be cleaned to maximize flood relief.

e. Engineering and Construction Schedule. To date, the Division of Waterways has not completed scheduling the entire project; however, funding has been approved for phases II and III (II.A.5.2). Phase IV may take priority over the scheduling and funding of phase III. Final design for any of the scheduled improvements mentioned herein has not yet been completed. Table 2, page II-26, presents the estimated cost of proposed improvements based on Division of Waterways October 1975 estimates which were escalated to October 1977 at a rate of 1 percent per month.

f. Methods of Construction. Proposed culvert construction would be of the open-cut method, except for two crossings under the MBTA Blue Line tracks. Pipe culverts under the tracks would be jacked into place, so that disruption to MBTA service would be minimized. The culvert under the Revere Beach Parkway (just across from the main entrance to Suffolk Downs) must be constructed by the open-cut method because of the location of the existing culvert (which would be removed). Culverts proposed for Reaches 3 and 5B may be supported on piles or possibly selected structural fill. Final design investigations are required before a decision is made on these alternative construction techniques. Channel modifications would be accomplished by clamshell excavation, because other methods such as hydraulic dredging are too cumbersome for the area involved.

TABLE 2. DETAILED COST ESTIMATES OF PROPOSED FLOOD CONTROL IMPROVEMENTS

Project	Estimated October 1975 Costs[1]	Estimated October 1977 Costs[2]
Pumping station at Bennington Street plus excavation of surrounding channel	$2,816,000	$3,586,000
Conduit under MBTA Blue Line tracks plus excavation of surrounding channel	272,000	346,000
Excavate channels and construct conduits at Suffolk Downs	1,173,000	1,494,000
Excavate channels south of Revere Beach Parkway (Reaches 2 and 5A)	218,000	277,000
Clean out conduit and channel serving Orient Heights watershed	25,000	32,000
Construct conduit under and north of Revere Beach Parkway (Reach 3)[3]	1,450,000	1,847,000
Construct new channel improvements to Garfield School Area (Reach 4)	612,000[4]	751,000
Improve main conduit system serving Beachmont area	263,000[4]	364,000
Enclose Green's Creek in new conduit (Reach 5B)	289,000	368,000
Total	$7,118,000	$9,065,000

[1] Division of Waterways.

[2] Includes engineering surveys, subsurface explorations, traffic control, MBTA force account, and 15 percent contingencies. The Division of Waterways October 1975 estimates were escalated to October 1977 at the rate of 1 percent per month.

[3] Reaches are shown on Plate 2, appended.

[4] Engineering surveys, subsurface explorations, traffic control, and MBTA force account divided proportionately between the two work items. Includes 14.7 percent contingencies.

g. Access to Construction Site. Four licenses were granted by the Commonwealth of Massachusetts, Department of Public Works, to the Belle Isle Reclamation District[1] (1932 and 1934) providing for the filling in of a major part of Sales Creek and for adequate drainage of the Sales Creek watershed to Belle Isle Inlet. License No. 1491 may provide grounds for access along the waterway from Reach 2 to Bennington Street, to maintain drainage facilities. An excerpt from License No. 1491 reads as follows:

> Adequate drainage for the territory formerly served by the portions of Sales Creek and Belle Isle Inlet to be filled soild, shall be provided as follows: (a) The northeasterly portion of Sales Creek in the location shown on said plan and marked 'Storage Basin' shall be left open without the filling authorized by said license No. 1400. From said storage basin, drainage shall be provided by an open waterway running southerly into Belle Isle Inlet, in the location shown on said plan and in accordance with the details of construction there indicated, (b) A culvert 7 feet by 9 feet shall be built, subject to the consent of the Boston, Revere Beach and Lynn Railroad Company, under the tracks of said railroad, in the location shown on said plan and in accordance with the details of construction there indicated, (c) Dredging shall be done to deepen Belle Isle Inlet to a depth of 2.5 feet at mean low water and a width of at least 10 feet between the culvert under said railroad and the existing culvert under Bennington Street, and southwesterly from the southwesterly end of said present culvert for a distance of approximately 400 feet, as shown on said plan. The licensee shall maintain the tide gate at the outlet of said culvert under Bennington Street, as constructed by the Department. Said drains and culvert shall be built and maintained in the locations shown on said plan and in accordance with the details of construction indicated, and the work shall be carried out in such manner that adequate drainage is provided at all times for the areas formerly drained by the portions of Sales Creek and Belle Isle Inlet in which solid filling is authorized. Nothing in this license shall be construed as authorizing any work on land or flats not owned by the licensee without the consent of the owner or owners of such property.

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[1] Although mentioned in the license, no further information on the Belle Isle Reclamation District was found.

The "Storage Basin" refers to Reach 5A and part of Reach 2. The open waterway is that part of Sales Creek extending from the storage basin to Bennington Street (Reach 1 and part of Reach 2). The culvert is the existing culvert under the MBTA Blue Line tracks (Reach 1). The last sentence in the excerpt may preclude construction work along the creek without permission from the existing owners of the land. (However, the transfer of land ownership (1935) from the Boston Port Development Co.[1] to the Eastern Racing Association Inc. states that such deed transfer is subject to drainage rights set forth in License Nos. 1400 and 1491.)

No other licenses pertaining to access to the remainder of Sales Creek for maintenance or construction purposes could be found except for the following legislative act (Chapter 873), directing construction of the culvert in Reach 3 near the intersection of the Revere Beach Parkway and Standish Road.

CHAPTER 873. AN ACT DIRECTING THE DEPARTMENT OF PUBLIC WORKS TO CONSTRUCT A CULVERT IN THE SALES CREEK AREA IN THE CITY OF REVERE

Be it enacted, etc., as follows:

The Department of Public Works, acting through its Division of Waterways, is hereby authorized and directed to construct a culvert in the Sales Creek area at the intersection of Revere Beach Parkway and Standish Road in the City of Revere.

Approved October 31, 1971

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[1] Although mentioned in the license, no further information on the Boston Port Development Co. was found.

6. Water Quality

a. Surface Water. Samples for water supply analyses were collected at stations indicated on Fig. 7 (page II-30). Samples were collected from stations 1, 2, 3, 4, 5, 6, and 7 during normal flow conditions. One sample from station 7 was collected after a period of heavy rain. Further testing at stations 2 and 7 was done, to determine the source of bacterial pollution, if any. Samples were labelled and identified with the appropriate serial numbers and subnumbers which match serial numbers on the field data sheet for each station. Samples for phenol, oil and grease, and metals were preserved in accordance with procedures presented in the Manual of Methods for Chemical Analysis of Water and Wastes, 1974. General chemical and bacteriological samples were cooled until analysis. Laboratory analyses followed procedures presented in the following manuals:

1. Standard Methods for Examination of Water and Wastewater. 14th Edition, American Public Health Association, 1975.

2. Manual of Methods for Chemical Analysis of Water and Wastes. Environmental Protection Agency, 1974.

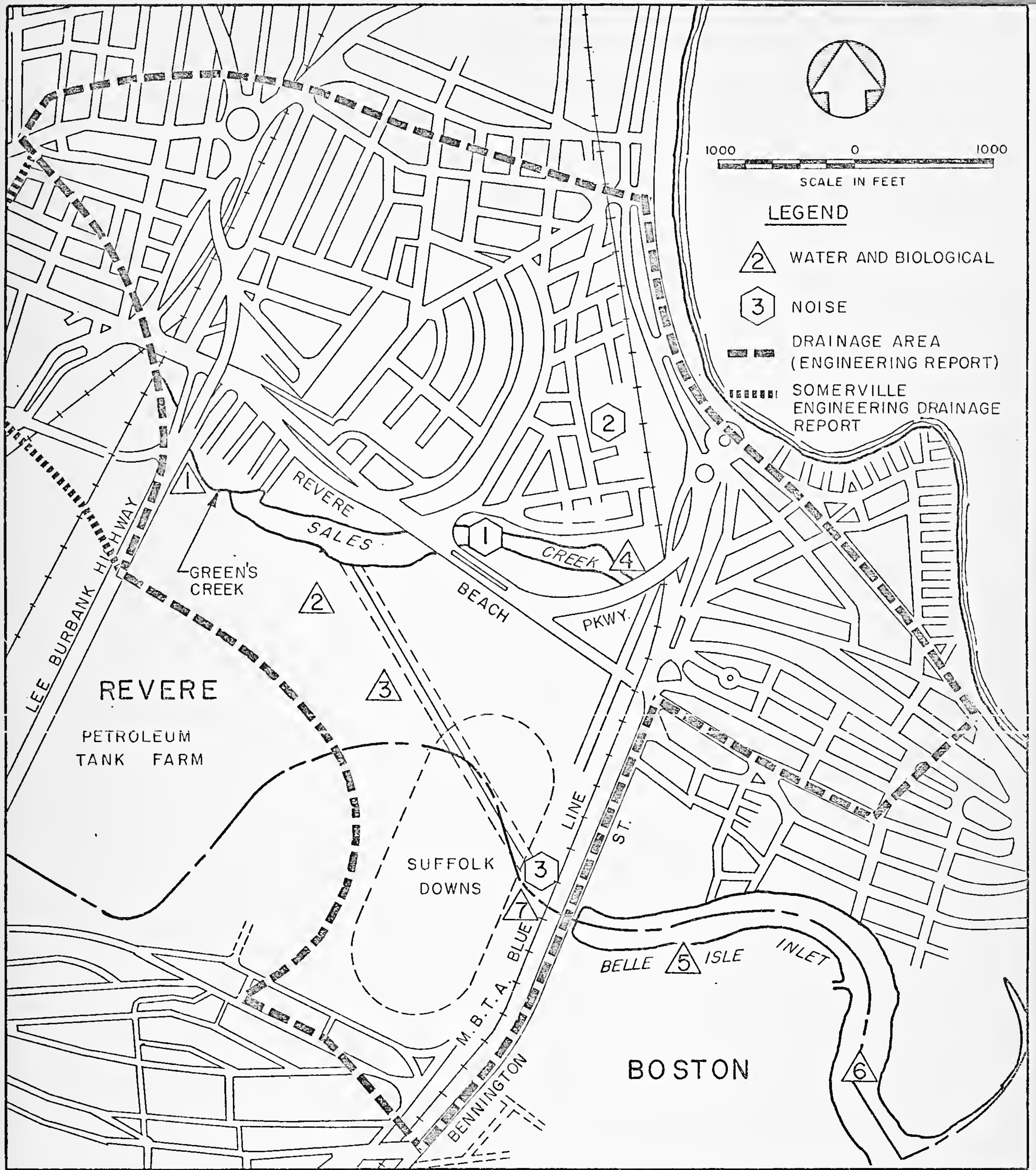
3. Chemistry Laboratory Manual Bottom Sediments. Environmental Protection Agency, 1969.

4. Strickland, J.D.H. and T.R. Parsons. A Practical Handbook of Seawater Analysis. Bulletin 167, 2nd Edition, Fisheries Research Board of Ottawa, Canada, 1972.

5. 1976 Annual Book of ASTM Standards, Part 31, Water. ASTM, 1976.

6. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. Environmental Protection Agency, 1972.

The results of laboratory analyses and field data sheet are contained in appendix C. The following is a discussion of water and sediment chemistry by several parametric categories:



COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATERWAYS
ENVIRONMENTAL IMPACT REPORT • SALES CREEK • REVERE, MASSACHUSETTS

FIG. 7 LOCATION OF WATER, BIOLOGICAL, AND NOISE MONITORING STATIONS

Temperature

All temperature levels in Sales Creek and Belle Isle Inlet were found to be within normal seasonal limits as influenced by shading, and water depth and flow.

Turbidity

High levels of turbidity were found at all stations in Sales Creek (range 56 to 84 JTU). Suspended materials and iron compounds are the main sources for turbidity levels. Turbidity in Belle Isle Inlet (caused by suspended materials such as clays) was higher at station 5, which is closer to Sales Creek.

Dissolved Oxygen (DO) and BOD.

DO levels in Sales Creek were found to range from 0.6 mg/l to 9.0 mg/l. The lowest oxygen concentrations were found at sample station 1 (0.6 mg/l), sample station 4 (1.5 mg/l), and sample station 7 (4.5 mg/l). Two of these stations also had the highest BOD levels of 21.0 mg/l (Station 1) and 21.5 mg/l (station 4), respectively. The highest oxygen concentration (9.0 mg/l) was found at station 2, where dense algal mats were present and certainly contributed much oxygen to the water. BOD at this location was the lowest in Sales Creek at 6.0 mg/l. Sample station 3 had 5.3 mg/l of oxygen and a BOD of 11.5 mg/l. Many DO levels in Sales Creek (those less than 5.0 mg/l) are less than standard for this creek. DO and BOD concentrations in Belle Isle Inlet were within normal levels.

pH, Alkalinity, Carbon Dioxide

The pH of waters in Sales Creek was within acceptable levels and ranged from 6.7 to 7.1. The pH in Belle Isle Inlet was somewhat higher at 8.2 and 8.1 for stations 5 and 6, respectively. Bicarbonate alkalinity was high at all sampling stations. Carbon dioxide was very high at all stations in Sales Creek and could very well have constituted a limitation on the survival of aquatic organisms. Carbon dioxide was also high in Belle Isle Inlet, which indicates a considerable amount of respiration.

Nutrients

All sample stations contained high concentrations of phosphorus, nitrogen, and inorganic carbons. Phosphorus levels were all above levels necessary for the growth of nuisance algae such as bluegreens. Ammonia nitrogen concentrations were variable, but much higher in Sales Creek than Belle Isle Inlet. Ammonia concentrations in Sales Creek were high enough to cast suspicion on the origin of this parameter. Nitrate nitrogen levels and inorganic carbon (particularly the carbon dioxide component) were also high and not considered of natural origin. While the water quality in Belle Isle Inlet is influenced by effluent water from Sales Creek and landfill on the marsh, there is also a natural and significant input of nutrients from the marsh itself.

Metals

Concentrations of copper and iron were high in Sales Creek with iron precipitates and colloids noticeable at all sample stations. Because of the presence of landfill on Belle Isle Inlet, it is not possible to evaluate the significance of iron inputs from the creek on the high concentration of iron in Belle Isle water. High copper concentrations in Sales Creek (range 0.24 to 0.38 mg/l) are enough to limit the survival of aquatic fauna. Synergism between the metals, oxygen levels, temperature, and other toxins would increase the toxicity of the water. Mercury levels were below the 0.5 mg/l allowable limit.

Oil and Grease

There were high concentrations of oil and grease at all locations. Roadway, parking lot, and truck terminal runoff are continuing sources for these hydrocarbons. Additionally, in the past, there have been several oil spills into Sales Creek and Belle Isle Inlet. Creek sediments contain extremely high levels of oil and grease.

Total Coliform and Fecal Coliform Bacteria

Within Sales Creek, the concentrations of these bacterial parameters were also very high and not attributable to natural sources. Total coliform bacteria concentrations ranged from a low of 2,000 per 100 ml at station 3 to a high of 400,000 per 100 ml at station 7. Fecal coliform bacterial concentrations ranged from 210 per 100 ml at

station 3 to 383,000 per 100 ml at station 7. Rainfall increased the concentrations of both total coliform and fecal coliform bacteria as evidenced by analyses conducted at station 7 on August 28, following nearly 1 inch of rainfall.

Input from the stable area of Suffolk Downs was also evaluated. On October 20, while Suffolk Downs was in operation, samples were taken at station 2 above the "Downs" and at station 7 below the "Downs." Samples were analyzed for total coliform, fecal coliform, and fecal streptococci bacteria. These analyses can be utilized to evaluate the potential source(s) for bacteria by applying the fecal coliform to fecal streptococci ratio (FC/FS). A FC/FS ratio of less than 1 suggests that the contamination is originating from livestock. (Such was the case for samples from both stations 2 and 7.) It should also be pointed out that concentrations of all bacterial parameters at station 7 were less than those at station 2.

The specific source(s) for high contamination levels at station 1, 3, and 4 are also not known, but, in conjunction with nutrient levels, BOD, and oxygen, suggest wastewater. The only conclusive means of establishing bacterial sources would be to intensively sample the creek.

Bacteria were not detected in Belle Isle Inlet. Whether this anomaly is attributable to the tidal stage, salinity, or the nonrandom distribution of bacteria is not known.

Salinity

There was some evidence of salt water intrusion behind the tide gates at Bennington Street. However, overall concentrations in Sales Creek as measured by a field hydrometer were less than 0.5 ppt, which indicate fresh water. The salinity of Belle Isle Inlet was 29.8 ppt and indicates true, not brackish, marine waters.

b. Sediment Quality. Bulk sediment chemical analyses were performed on sediment samples from stations 2 and 6. Results of these analyses are contained in appendix C.

From inspection of the data, it is clear that sediments from Sales Creek contain extremely high concentrations of heavy metals. Most notable among these are iron, lead, and zinc. Copper and chromium were present at relatively moderate concentrations, and mercury and cadmium were present at low concentrations. Because of a history of spills in Sales Creek, sediments were also found to contain very high concentrations of oil and grease. Prior to the installation of tide gates at Bennington Street, flood tides would spread pollutants as far as Reach 3 (1)[1] (as evidenced by the spread of oil spills). Therefore, these sediment qualities may be considered representative of much of the remainder of Sales Creek. Sediments at sample station 2 were soft and unconsolidated and had more petroleum odors than sulfide.

Sediment from Belle Isle Inlet was also found to contain high concentrations of zinc, lead, copper, and chromium. Low levels of mercury and

[1]See bibliography, appendix D.

cadmium were found. While not as high as in Sales Creek, the concentration of oil and grease in the Belle Isle Inlet sediment was indicative of past pollution.

c. Stream and Inlet Classifications. Sales Creek has not been intensively surveyed by the Massachusetts Division of Water Pollution Control. Rather the agency's involvement has been limited to investigations of complaints in the area. Oil spill investigations and wastewater discharge violations from local establishments have been cited by state officials. The Revere Board of Health has also investigated some point sources of pollution. Sales Creek is currently classified B[1] more by policy than investigation. Water quality with respect to oxygen levels, bacterial concentrations, and sludge deposits are major determinants of the present condition.

Belle Isle Inlet is classified SB, but its present condition is SC. Class SB waters are marine waters, suitable for bathing and recreational purposes (including water contact sports), industrial cooling, excellent fish habitat, good aesthetic value, and certain shellfisheries with depuration.[2] Class SC waters are marine waters, suitable for aesthetic enjoyment, recreational boating, wildlife habitat, common food, game fishes indigenous to the region, industrial cooling, and process uses. Shellfishing is not permitted, because Belle Isle is closed by the Department of Environmental Quality Engineering because of bacterial contamination.

[1] Fresh water suitable for bathing and recreational purposes.

[2] Artificial means of cleaning shellfish which have been contaminated with bacteria.

d. Sources of Pollution.

Point Sources

In the past, point sources of pollution which have been investigated include kitchen drainage into Sales Creek, discharge of oil from trucking terminals, and oil spills (1) from oil tank farms and catch basins. There has also been nondescriptive mention of combined wastewater discharges. Currently, the only confirmed point sources are catch basin drainages. However, the possibility of combined sewer system overflows still exists. As best as can be determined, contribution from landfill on the salt marsh, in terms of water quality, has never been investigated.

Nonpoint Sources

The contribution of pollutants through nonpoint sources is limited to runoff. Because street and parking lot drainage is generally handled by catch basins and culverts, the contribution of other runoff is minimal. Some oils and grease may originate from terminals. Surface drainage in the stable area of Suffolk Downs is also handled by drainage culverts and basins.

7. Air Resources

a. Climatology. Massachusetts lies in a zone of temperate continental climate. Its coastal areas, such as the Sales Creek area, however, are subjected to considerable maritime influence because of proximity to the Atlantic Ocean. Winters are warmer and summers pleasantly

cooler than locations slightly inland because of the ocean's tempering effects, resulting in smaller diurnal temperature ranges. The continental influence is nonetheless dominant, because prevailing winds are from the west. Wind direction is subject to moderate variability from low pressure systems which traverse the area, shifting wind direction and alternately importing cooler and warmer air. These systems provide most winter precipitation but a lesser portion in the summer, when local showers and thunderstorms are a major source.

The highest temperature of the year is often 90^{0} Fahrenheit (F.) to 95^{0}F. During some summers, the temperature does not rise above 90^{0}F: nights are usually cool with readings in the 50s and 60s. The average temperature in summer (June-August) is 68^{0}F. and varies little from year to year. The average winter (December-February) temperature is about 29^{0}. During some winters, the temperature never falls below zero, yet during others, as many as 20 days with subzero temperatures may occur.

Although the month-to-month average precipitation is fairly constant, and no "wet" and "dry" seasons exist as such, there is a notable decrease during summer. The May through August period averages about 2 1/2 to 3 in. per month, whereas the winter and spring months receive about 4 in. each. Rarely does any month experience more than 10 in. of precipitation or less than 1. Short periods of drought may occur in any season. The annual precipitation, averaging about 43 in., is fairly constant from year to year, however, and usually provides enough water to combat drought.

The bulk of snowfall occurs from December through March, although measurable amounts fall in April, October, and November, and traces are sometimes

found in May. The amount of annual snowfall is subject to wide variation from year to year and from location to location in the North Shore area. Rockport, for example, receives an average 47.1 in. of snow per year, whereas Reading receives an average 71.1 in. The Sales Creek area should receive about 60 in. per year, ranging from about 10 to 90 in. at either extreme.

All data and information in this section has been taken from Climatological Summary publications of the Environmental Science Service Administration for substations at Cape Ann and Reading, Massachusetts. In many instances, interpolation of data from the two stations was necessary to approximate the climate of the Sales Creek area.

b. Air Quality. Ambient air quality was not monitored for this assessment. Data were gathered, however, from the Massachusetts Air Surveillance Network. Their station in Revere records concentrations of total suspended particulates, sulfur dioxide, and nitrogen oxides. The annual summary for 1975 shows that air quality in the area is relatively good. The mean annual TSP concentration was 54 ugm/m^2, with a peak 24-hour value of 128 ugm/m^2. The Federal Primary Air Quality Standard for the 24-hour value is 260 ugm/m^2. Sulfur dioxide showed an average concentration of 0.011 parts per million (ppm) in 1975, with a maximum 24-hour value of 0.050 ppm, once again below standards (0.14 ppm for a 24-hour average). Nitrogen oxides exhibited an annual average value of 0.033 ppm, as compared to a standard for the average annual concentration of 0.05 ppm. Thus, in terms of these three important air contaminants, the area did not exceed Federal Primary Air Quality Standards in 1975.

c. Noise. Three noise quality sites (shown on Fig. 7) were established in the project area, to document ambient and peak level noise in the area which would see construction activities. Noise levels were measured on the A-weighted decibel scale with a Bruel and Kjaer Environmental Noise Classifier. Measurements were taken between 3:30 and 4:30 P.M. on Friday, August 27, 1976.

Station 1 was monitored for daytime ambient noise levels. The L_{90} noise level was 61.5 dBA, the L_{50} noise level was 68.5 dBA, and the L_{10} noise level was 74 dBA. These sound levels are exceeded 90, 50 and 10 percent of the time, respectively, and can be characterized as background, average, and peak levels. Land surrounding station 1 is in FHWA Land Use Category C (Developed Lands) and is subjected to a noise standard of L_{10} = 75 dBA. Thus, the area at station 1 is just under the noise standard.

Station 2 is located in the playground of the Garfield School. Ambient noise measurements showed that L_{90} was 52.5 dBA, L_{50} was 54 dBA, and L_{10} was 67 dBA. The school falls into FHWA Land Use Category E (schools, hospitals, etc.) and is subjected to a standard of 55 dBA interior L_{10} noise level. This would imply an exterior value, at the building wall, of 65 dBA. The measurement taken at station 2, some 100 ft from the school, is, thus, just about at the standard.

Peak noise measurements were taken at station 3, near the site of the proposed pumping station. This is the only area where nonconstruction noise might be a problem. Operation of the pumps, although irregular, might occur during peak traffic hours. Measured noise levels (from rush-hour traffic

on Bennington Street) were L_{90} = 59.5 dBA, L_{50} = 68 dBA, and L_{10} = 77.5 dBA. This site, like station 1, is in FHWA Land Use Category C (Developed Lands) and, while subjected to an L_{10} noise standard of 75 dBA, already sees peak-hour noise levels in excess of this standard.

B. The Biological Environment

1. Vegetation

Naturally vegetated sites within the watershed, including fresh and salt marshes and abandoned field communities, are primarily limited to the banks of Sales Creek, Belle Isle Inlet, and areas along previously constructed drainage ditches. The floral diversity exhibited by many of these sites, especially the fresh and salt marsh communities, is quite low, with several sites being predominately composed of only a few species.

A discussion of the vegetation of the watershed by reach is presented below. Appendix E contains a representative list of common and scientific names of plant species.

Reach 1. The freshwater marsh community south of Sales Creek on either side of the MBTA Blue Line and north of Sales Creek between the MBTA and the racetrack is nearly homogenous, with reed grass being the dominant species. However, between the MBTA and Bennington Street north of Sales Creek, there is an abandoned field community existing on disturbed soil caused by previous construction activity. The dominant species in this area include common ragweed, wild carrot, burdock, Japanese knotweed,

pinkweed, sunflower, groundnut, barnyard grass, trefoil, various species of aster, and some reed grass. Also, along the banks of Sales Creek northwest of the race track, reed grass is once again the dominant species.

Reach 2. Streambanks in this area are nearly homogenously composed of reed grass. Also, between Sales Creek and the access road leading into Suffolk Downs from Revere Beach Parkway is an area of mowed grass.

Reach 3. Along the banks of Sales Creek, reed grass is the most abundant species, although on the North Shore, some smooth sumac and mature weeping willows are present. An area of fresh marsh, located along the north shore of Sales Creek at the end of Standish Road, also exhibits a uniform floral composition, because reed grass extends over the entire site.

Reach 4. This is the only area of natural vegetation, except for the fresh marsh described in Reach 3, occurring in a narrow strip beside the creek. In this area, floral diversity is much greater than in any of the areas previously noted. Plant species include reed grass, cattail, water-smartweed, bur-marigold, salt-meadow grass, tearthumb, rushes, common elderberry, burdock, common milkweed, Japanese knotweed, and water-plantain.

Reach 5A. As is the case with most other areas along the creek, the dominant species along the streambanks in this area is reed grass. Between the oil tanks and the access road leading into Suffolk Downs from the Lee Burbank Highway, however, is a marsh community of slightly greater diversity. In this area, such salt marsh species as salt-meadow grass and salt-water cordgrass (in addition to reed grass) are quite abundant and indicate

a slightly saline environment. Also, because of the site's contour, numerous large pockets or puddles of water are present.

Along the northern shore of Sales Creek in this area is an abandoned field community very similar to the one described in Reach 1. The primary plant species in this site include smooth sumac, common milkweed, wild carrot, barnyard grass, pinkweed, common St. John's wort, common ragweed, and various species of aster. Large drainage pipes are also present on the site.

Reach 5B. Here, the only areas of natural vegetation are located along the banks of Sales Creek and between the oil tanks and the aforementioned access road. Both areas are nearly homogenous, with reed grass being the dominant species.

Belle Isle Inlet. Belle Isle Inlet, east of the Bennington Street tide gates and adjacent to an abandoned drive-in, supports a large salt marsh community primarily composed of salt-water cordgrass and salt-meadow grass. Along the shores of the salt marsh, however, sea-lavender, glasswort, orach, and reed grass are also present. Within the area of the drive-in, revegetation is beginning to occur. The dominant species, including reed grass, spike-grass, barnyard grass, spiraea, rose, wild carrot bayberry, weeping willow, black cherry, smooth sumac, quaking aspen, and various species of rushes, are all well established. Pockets or puddles of water are also abundant on the site, allowing for the growth of aquatic species. Such plant species as sea lettuce, rockweeds, *Enteromorpha* spp., and *Ascophyllum nodosum* have been observed in the estuary. Lombardy poplar are currently growing on the site of the drive-in.

2. Wildlife

a. Game and Non-Game Species. With the exception of salt marshes in Belle Isle Inlet, the extreme urban environment of which the Sales Creek study area is a part, plus the creek's present condition and status, offer little in the way of suitable environments for wildlife. Because upland habitats such as forests and successional areas (shrub and abandoned fields) are either nonexistent or relatively few in number, and vegetation of low-land fresh and salt marsh habitats in Sales Creek west of the Bennington Street tide gates is so homogenous, both the diversity and number of wild-life species present is expceted to be minimal. A list of wildlife common and scientific names is contained in appendix F.

Sales Creek and naturally vegetated sites (abandoned fields and marshes) located south of Revere Beach Parkway, in addition to the area of the creek located behind Garfield School, offer the least favorable conditions for wildlife. South of Revere Beach Parkway (Reaches 1, 2, 5A, and 5B), the greatest limiting factors to wildlife, and especially its diversity, are the homogeneity of natural vegetation and the turbidity of the water. Between the race track and the Bennington Street tide gates, these factors may be extended to include the limited amount of open water, water quality, and noise created by the MBTA. The only viable wildlife habitat in this area is located between the oil tanks and the access road leading into the Downs from the Lee Burbank Highway. In this area, water collects in large pockets or puddles, creating a suitable habitat for roosting and feeding shore birds. These include black-backed gulls, herring gulls, terns, black-bellied plovers, and a variety of species of sandpipers. Also in this area are large sections of mowed grass which may tend to attract cottontails.

The area of Sales Creek along Reach 3 and the fresh marsh located at the end of Standish Road offer little more in the way of favorable wildlife habitats than those areas previously described. Although the water is somewhat less turbid, possibly favoring the presence of muskrats, the uniform composition of the vegetation and the amount of refuse strewn about the areas, with the latter undoubtedly attracting rats, once again limit the extent of wildlife.

The most valuable wildlife habitat is the salt marsh of Belle Isle Inlet. This area offers food (plant material and a myriad of invertebrates), cover, water, and nesting sites to a variety of shore birds and migratory waterfowl. These may include, for example, Canada Geese, mallards, black ducks, green-winged teal, clapper rails, curlews, snowy egrets, seaside sparrows, and sharp-tailed sparrows. Occasionally snowy owls may be found in the marsh as well.

Problems with rodent populations along the Blue Line, behind Cerretani's Market, Suffolk Downs, and landfill on the Belle Isle Marsh, and other areas of Sales Creek have mandated rodent control measures at those locations.

b. Rare and Endangered Species. There were no rare and endangered species of plants, fish, amphibians, reptiles, birds, or mammals resident in the watershed or within Belle Isle Inlet. This is not to say that such species, particularly migratory waterfowl, raptorial and passerine birds, never occur. From time to time some individuals may pass through the region.

3. Aquatic Life

a. Benthic Organisms. Sales Creek and Belle Isle Inlet were sampled for benthic organisms (those organisms which live in the stream bottom) at all water sampling stations (indicated on Fig. 7). The areas within Sales Creek were sampled with a 0.09m^2 surber sampler, and a 0.05m^2 ponar dredge was used to sample Belle Isle Inlet. Fauna and flora were separated from mud and debris in the field and preserved in a 10 percent buffered formation solution. Samples were labelled and taken to the laboratory for identification. The Shannon-Weaver Index of species diversity was used to evaluate species diversity and ecosystem stability. Organisms found at each sample location are indicated in appendix G, and water quality implications are discussed below.

Sample Station 1

Only snails (*Physa*) and tubificial worms (*Limnodrilus*) were found at this location. Worms, which were most abundant, are tolerant to high levels of organic and nutrient enrichment. They are also tolerant of low oxygen concentrations; at the time of sampling, 0.6 mg/l of DO was found. *Physa* snails were also abundant, indicating nutrient enrichment. Periphyton growths of filamentous algae were noted, and it is this algae upon which the snails were feeding. The very low species diversity in this benthic community indicates unstable physical, chemical, and consequently, biological conditions. Erratic changes in water flow as well as poor water quality can lead to such low diversities. The biological data correlates well with water quality

information. Moderate amounts of the iron bacterium Crenothrix polyspora were also found at this station.

Sample Station 2

Only one species, the dragonfly Erythemis, was found at this location. This dragonfly is reported to have a wide tolerance for concentrations of chloride, hardness, calcium, magnesium, sulfate, and turbidity. It is not, however, reported to be found in poorly oxygenated waters. Roback(2) reports that Erythemis inhabits waters with levels of oxygen of about 8.0 mg/l, which agrees with our finding of this insect in water containing 9 mg/l of DO. Dragonflies are not true infaunal habitors, i.e. they do not characteristically inhabit or burrow into sediments but rather seek shelter in debris and vegetation and actively swim in the water column. The lack of true infaunal organisms at this sample station is because of the chemical characteristics of the creek's sediment: high concentrations of oil (from previous oil spills), low redox and anaerobic sediments, and heavy metals. The lack of any diversity exemplifies the poor quality of the water and sediment.

Sample Station 3

The benthic community at sample station 3 did not exhibit any species diversity. Only one species, the midge Chironomus (blood worm), was found in the sediment. This organism is tolerant of a wide range in levels of organic and nutrient enrichment and is also found in waters with low to high concentrations of DO. The oxygen concentration at the time of sampling was 5.3 mg/l. In view of the wide tolerance limits

exhibited by this organism, this species is not particularly valuable as an indicator for water quality. However, the lack of a community species diversity indicates the poor physical and chemical quality of this location.

Sample Station 4

As at other sampling locations, this station did not exhibit any species diversity, and the only infaunal organism found was the pollution tolerant worm Limnodrilus. This lack of diversity and the known tolerance of this organism indicates, at least, chemical, if not physical, stress in this environment.

Sample Station 5

This sample station is located in Belle Isle Inlet, where salinity values of 29 to 30 ppt were noted. The benthic species diversity index was moderate and indicated a healthier and more stable ecosystem than did the most abundant. The bivalve, Astarte castanea, was the second most abundant organism. Soft-shelled clams, ribbed mussel, mud snails, another worm species, and an isopod were other organisms found. These organisms are common in healthy estuaries and serve as food for many fish.

Sample Station 6

This station was located near the landfill on the salt marsh. This location also contained a low benthic species diversity, and the community was dominated by the bivalve Astarte castanea. Polychaete

worms were not as common as at station 5; however, the two species found are common in estuaries such as Belle Isle. Other organisms present include the soft-shelled clam, mud snail, small bivalves, and isopods.

Sample Station 7

While salinity fluctuations of from 0.5 to 1.0 ppt were noted at this station over a period of several days, the finding of only Limnodrilus indicates the same conditions as at other upstream areas.

Belle Isle Inlet has been systematically sampled from time to time by personnel from the Massachusetts Division of Marine Fisheries, primarily to evaluate stocks of soft-shelled clams. The most recent inventory was conducted in November 1972. At that time, Belle Isle Inlet was found to contain stocks of soft-shelled calms: about 4,866 bushels of intermediate size clams and 8,064 bushels of legal size clams. This set of soft shells is considered excellent and, if harvestable, would have a market value of $191,520.00 for the legal size clam. This value is based on the July 1976 wholesale price from Essex County of $23.75 per bushel. However, harvesting of shellfish in Belle Isle Inlet is prohibited by the Massachusetts Department of Environemntal Quality Engineering because of bacterial contamination.

In addition to soft-shelled clams, Marine Fisheries personnel also noted the presence of blue and ribbed mussles, duck clams, mud snails, clam worms, and the marine blood worm or beak thrower Glycera spp.

Belle Isle Inlet, therefore, is quite productive and has good potential economic value. The basic source of support for this production lies in the energy cycling within the salt marsh itself.

b. Marine Life. The principal organisms considered under this category are the finfish in Belle Isle Inlet. Altough limited sampling has been conducted in the past, mummichug, Atlantic silverside, and winter flounder have been found. It is also very likely that such other finfish as American eel, Atlantic tomcod, sticklebacks, grubby, little skate, northern pipefish, red hake, and shorthorn sculpin will be noted periodically in the inlet. Such a suite of finfish has been found in the Pines River in Lynn, which, although larger, is similar to Belle Isle Inlet. Sportfishing, particularly for flounder, is common adjacent to the crossing for Route 145 in Winthrop and East Boston.

Rock, spider, and horseshoe crabs are other examples of marine life which may also inhabit Belle Isle Inlet. Tidal fluctuations and shallow water depth are not amenable for lobster.

c. Aquatic Life. Very limited amounts of fish are found in Sales Creek. Minnows have been observed in the creek from the foot bridge adjacent to north of the Garfield School. Fish were not seen at any other sites on Sales Creek.

Salt marsh mosquitoes Aedes sollicitans are common in the area. Their prime breeding areas are, of course, the pools in the Belle Isle Inlet marsh. However, brackish pools and waters, such as these at Reach 5A and

parts of Sales Creek (where salinity is high enough) would also allow breeding. The entirety of Sales Creek can be considered good mosquito breeding habitat either for salt marsh mosquitoes or other fresh water mosquito groups. Mosquito control is practiced during the summer and is directed only at the adult stages.

4. Ecosystem Characteristics

a. Trophic and Habitat Relationships. Water quality analyses show that the water in Sales Creek is enriched with nitrogen, phosphorus, and carbon. Based on water type, one would have to classify this watercourse as euthropic and culturally polluted. Opportunities for a significant aquatic food chain are not present. Primary limitations are water quality and physical parameters such as water depth, temperature, turbidity, and erratic changes in water flow. High water temperature coupled with low concentrations of DO and/or high levels of ammonia, nitrate, phosphorus, oil and grease, and other parameters would limit the potential for beneficial primary producers. Field observations indicated the presence of bluegreen algal mats, particularly at Station 2. Under present water conditions, the aquatic food chain would be limited to those zooplankton and benthic organisms tolerant of polysaphrobic[1] to mesoprobic[2] conditions. Even in the presence of tolerant zooplankton and benthic organisms, the only likely fish inhabitors would be the trash species, particularly suckers and carp. Game species of finfish would not exist under present physical and chemical conditions.

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[1] High level of oxidizable organic material in water. There may be high BOD and low DO levels associated with this condition.

[2] Moderate level of oxidizable organic material in water.

The major vegetation along Sales Creek is Phragmites communis, a common species which occurs along roadside ditches in shallow water and in portions of brackish marshes having a fresh water source. The present watershed is a typical habitat for these species. Phragmites is of little value as wildlife food except for the rootstalks, which are eaten by muskrats. Stands of this vegetation do provide cover for wildlife, however. Rodents will populate the stands, and redwinged black birds can nest and breed.

The plants found growing on the fill in some areas adjacent to the streams channel are annuals, aliens, and roadside weeds common to disturbed sites. Some plant species provide seeds and browse for wildlife. However, neither the vegetation growing in the channel nor that on the adjacent areas is extensive enough to afford a significant food or cover source. Moreover, many of the plant species are typically those which occur in waste places and on recently disturbed sites; such habitats are very commonplace in and around centers of human activity.

The water in Belle Isle Inlet is also enriched, but more from natural than cultural causes. The growth and decay constantly going on in the salt marsh contribute significant amounts of energy particularly in the forms of nitrogen, carbon, and phosphorus compounds. There were, however, higher concentrations of turbidity, inorganic carbon, phosphorus, and oil and grease closer to the inlet from Sales Creek. In view of the species diversity and presence of shellfish and finfish stocks, Belle Isle Inlet is considered to be in a reasonable state of health in view of its surroundings and inputs.

The two species of Spartina which were observed growing in the marsh are the two dominant species found in tide-influenced saline marshes in the

northeast. Spartina alterniflora commonly grows along channels and in lower marsh elevations, where soils are more or less continually saturated with salt water. Spartina patens, on the other hand, requires alternating cycles of exposure and inundation and occurs in high areas of the marsh which are only inudated occasionally. Both species of saltmarsh cordgrass are important sources of food to certain species of wildlife (black ducks and seaside and sharptailed sparrows (3)). Root stalks are an important food for Canada goose and muskrat. Egrets and sandpipers feed in the shallows and drainage ditches in the marsh. Owls and hawks may be seen preying on small mammals in or along the marsh and landfill.

b. Succession of Vegetation Gradients. The entire Sales Creek watershed is in the process of secondary ecological succession. All of the natural ecosystem has been disturbed at one time or another by man's encroachment, and the natural vegetative types have been replaced by species characteristic of disturbed and wasted areas. Such high degrees of disturbance simplify the ecosystem and decrease diversity values, thus, support is not provided in the form of food or habitat for significant amounts of wildlife. Therefore, in terms of vegetation and wildlife support capacity, Sales Creek must be ranked low.

The viable parts of the salt marsh on Belle Isle appear to be still in primary ecological succession. These are the areas with extensive stands of Spartina plants and associated flora. However, abandoned drive-in and landfill areas on the marsh are disturbed, and ecological succession has been altered, so that secondary succession is underway. The transitional area between disturbed vegetation areas and the salt marsh habitat, supports a greater diversity of fauna than either area would have supported by itself.

C. The Social Environment

1. Characteristics of the Population

a. Population, Employment, and Income Characteristics. The city of Revere, Suffolk County, has a stable population base. No great change has occurred in the past 25 years in approximate total numbers and growth rates, as shown below.

TABLE 3. POPULATION TRENDS 1950 THROUGH 1975
REVERE, MASSACHUSETTS[1]

	1950	1955	1960	1965	1970	1975
Population	36,800	39,600	40,100	42,400	43,200	41,300
Density (per sq mile)	6,180	6,660	6,740	7,130	7,260	6,940

[1] Even years represent U.S. census data. Odd years represent Massachusetts census data.

Approximately 50 percent of the population is of Italian descent. Other nationalities represented are Russian and Canadian, but each has only about 10 percent representation.

The percentage of minorities is 0.20 percent. The median age of the population was 33 in 1970 as compared to 29.1 for Boston. Revere's population is generally older, 11.4 percent was over 65 in 1970, the last date for which distribution figures were available.

The watershed includes parts or all of four census tract blocks and a total estimated population of about 10,000 based on the 1970 "U.S. Census of Housing." Of that population, an estimated 1,400 persons are located in areas reported by local officials to be subjected to flooding, and about 2,000 are located in areas which are preliminarily designated as flood-prone by the FIA and/or are reported by local officials to be subjected to flooding (Fig. 6, page).

Revere is a residential suburb of Boston and a summer resort city. Employment in Revere is heavily concentrated in the service and trade sectors. In 1970, of the 31,775 persons 16 and over, 60.4 percent were in the civilian labor force. Of these, 61.7 percent were male and 38.3 percent were female. Recent (1974) figures for employment by industry as well as 1970 occupational characteristics are shown in Table 4, page .

Income characteristics for 1970 are given in Table 5, page , and are compared with statistics for the city of Boston. Revere has a higher percentage of incomes under $3,000, a lower percentage of incomes over $15,000, and lower median and per capita incomes than the city of Boston.

TABLE 4. 1974 EMPLOYMENT CHARACTERISTICS
REVERE, MASSACHUSETTS

Industry	Number of Firms	Number of Employees Average (Annual)	Distribution (Percentage) of Total Employment
Agriculture	9	44	0.7

Construction	64	346	5.5
Manufacturing	21	429	6.9
Transportation, Communication, and Utilities	42	273	4.4
Wholesale and Retail Trade	264	3,367	54.1
Finance, Insurance, and Real Estate	21	81	1.3
Services	155	1,687	27.1
Total	576	6,227	100.0

Source: Division of Employment Security

1970 OCCUPATIONAL CHARACTERISTICS, REVFRE, MASSACHUSETTS

Group	Number Employed	Percent of Total
Professional, technical, and kindred	1,908	10.5
Managers, etc.	1,265	6.9
Clerical	4,664	25.6
Sales	1,581	8.7
Craftsmen, foremen	2,684	14.7
Operatives	3,029	16.6
Household, service	2,414	13.2
Laborers	696	3.8
Total	12,454	100.0

Source: U.S. Census Bureau

NOTE: The first table includes employment within the city limits of Revere; the second table includes occupational characteristics of those living in Revere who may work in Boston or elsewhere.

TABLE 5. 1970 INCOME CHARACTERISTICS, REVERE, MASSACHUSETTS
(Compared to the City of Boston)

Income	Percentage Revere	Percentage Boston
Under $3,000	7.3	6.1
$3,000 to 5,999	12.9	10.8
$6,000 to 9,999	27.4	23.2
$10,000 to 14,999	31.4	29.8
$15,000 and over	21.0	30.1
Median income	$10,325	$11,449
Per capita income	$ 3,239	$ 3,713

Source: Census Bureau

b. Future Growth Trends. The Central Transportation Planning Staff (CTPS) of the Metropolitan Area Planning Council (MAPC) has adopted the population projections presented in Table 6. These figures reflect a projected total increase in population of about 5,000 persons during the next 25 years, a cumulative increase of 12 percent and an average annual increase of about 0.5 percent.

TABLE 6. POPULATION PROJECTIONS FOR REVERE, MASSACHUSETTS

1970 U.S. Census Data	1975 Massachusetts Census	Projected Population Year 1990	Projected Population Year 1995	Projected Population Year 2000
43,160	41,292	45,750	46,000	46,250

2. Community and Social Services

a. Housing. The total number of housing units[1] in 1970 within the watershed was equal to 3600, 26 percent of total housing in Revere. Of these, just less than half were owner-occupied, and a little more than half were renter-occupied. It is estimated that about 500 housing units are reported by Revere officials to experience flooding problems and about 700 housing units have either been reported to have flooding problems or are within the 100-year flood area preliminarily designated by the FIA. Of the 14,635 housing units in the city, 14,026 were occupied, and 289 or 2.0 percent were vacant and available. There were very few mobile homes in Revere: 67 in 1970, all within the watershed.

Approximately 64 percent of the total homes were built before 1939. The 1970 median value of one-unit structures was $23,800, and the median of persons-per-unit was 2.7. For renter-occupied housing, the 1970 median rent was $94.00.

Many housing units in the Beachmont areas and in areas north of the Revere Beach Parkway do not have basements because of potential flooding. Much of the area is reclaimed marshland, and the drainage problems discussed previously cause flood damage to some of these homes.

b. Social Services. Social services are provided through various church and community groups as well as by the Massachusetts Department of

[1]A housing unit is defined as living quarters intended for residential use, a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. These figures include all year-round units (including vacant dwellings). No seasonal or units for migratory labor were included.

Public Welfare. One in ten persons, individually or as a member of a family, received assistance in Revere as compared to one in six persons for the city of Boston.

c. Transportation/Access. The proximity of Revere to Boston and the suburban nature of this area and the municipalities to the north make transportation access a necessity. Commuter traffic from the north causes congestion of the Revere Beach Parkway and roads leading to East Boston and the Mystic River Bridge. A planned bypass, to extend from north of the beach in a westerly direction would relieve this area by funneling traffic traveling to Boston.

Revere is served by rail, highway, bus, and MBTA. The Boston and Maine (B & M) Railroad provides rail freight service to the city. The highway network is due to be improved; however, the condition of the public roads is generally good. A renovated Wonderland MBTA station is scheduled to be built north of the study area. Logan International Airport is a 5-minute drive.

Lee Burbank Highway as well as Revere Beach Parkway, crossing each other at right angles, are the major roadways in the study area. Revere Beach Parkway swings north at the center of this area to Eliot Circle, where it then becomes Revere Beach Boulevard. Winthrop Avenue, extending south from Eliot Circle, cuts the south end of Roughan Point and follows the ocean south toward Short Beach and Winthrop. Traffic data was available for February 1975 for both Lee Burbank Highway and Revere Beach Parkway.

Lee Burbank Highway at East Boston line:	Number of Vehicles
Northbound (3-day average)	17,850
Southbound (3-day average)	18,900
Revere Beach Parkway 200 ft north of Winthrop Avenue/Route 16:	
Southbound (4-day average)	8,284

Traffic data for 1971 for the Wonderland Dog Track and the Suffolk Downs Race Track were available. On the average, 7,500 cars park at Wonderland on a season day (5/13 to 9/5 in 1975), and 4,000 cars park at Suffolk Downs on a season day (10/1 to 7/1 in 1971). (However, these dates may change each year.)

d. Educational Facilities. Many schools are located within the watershed; the ones which would benefit most directly from the project are located in Beachmont and south of Curtis Park (Reach 4). Beachmont has three elementary schools which are scheduled to be replaced by a new school to be built at a site at Frederick's Park. (Federick's Park is outside the study area, although it drains to Belle Isle Inlet.) Two of the schools were built in 1888, the third is a small, five-room structure. The new Beachmont school, currently being constructed, will house Kindergarten through Grade 8. The area at Frederick's Park, which is subjected to frequent flooding, would be filled an average of 4 ft in depth. The Garfield School, located at Curtis Park, is adjacent to Reach 4 and has a long history of flooding.

e. Recreational Facilities. The well-known, privately-owned Suffolk Downs Race Track is located in the watershed; Wonderland Dog Track is located

in Revere, but to the north of the watershed. Crescent or Revere Beach under the jurisdiction of the Metropolitan District Commission (MDC) has served the area for over 50 years. Adjacent to it is a major amusement area.[1] These tracks and local beaches attract many visitors to the city. The MDC has preliminary plans for a "Belle Isle Park" to be located southeast of Suffolk Downs in Boston along Belle Isle Inlet at an abandoned drive-in theater site. Plans include opening the canal which now curves through marshland at the site, building a pier, and creating open green areas. A small island would be created by the opening of this canal. The MDC now owns part of the proposed park site and is in the process of acquiring marshland in the inlet from the Massachusetts Port Authority. Curtis Park adjacent to Reach 4 is the only park located in the watershed.

3. Utilities

The area is served by Boston Gas through Mystic Valley Gas and by the Massachusetts Electric Company; water is supplied by the MDC which delivers water to community distribution systems. Wastewater is intercepted from community sewer systems and treated by the MDC at Deer Island. Present plans call for the expansion of the Deer Island plant to provide secondary treatment. Revere's sewer system is reported to be completely separate from the drainage network (i.e., no combined sewers or connections between sanitary pipes and storm drains). There also reportedly

[1]Much of this amusement area is under demolition and is proposed to be replaced by a major apartment-commercial redevelopment project.

are no wastewater or combined wastewater overflows in the city. Illegal wastewater discharges, while not found during this investigation, may exist.

4. Land Use and Land Use Controls[1]

a. Present Zoning. Existing zoning within the watershed is classified as general or major commercial, heavy or light industrial, one-family or general residential, amusement and apartment, or apartment/business (Fig. 8). Much of the study area is classified as heavy industrial. The Revere portion of Suffolk Downs is zoned for commercial use; the Revere portion of the study area is zoned for general residence. The East Boston section of Suffolk Downs is zoned for retail business, and the remaining East Boston portion of the watershed is primarily residential. The portion of East Boston along the Inlet (outside the watershed) is zoned for general manufacturing, but, as noted above, a park is planned in this area.

b. Land Ownership Characteristics. The heavy industrial area (oil and gasoline tanks) within the watershed is owned by several private oil companies. Suffolk Downs Park, although considered a recreational area, is privately owned and operated for profit. A few other commercial businesses in the watershed are operating along Winthrop Avenue and the Parkway, and a few are dispersed along Bennington Street. A majority of the area is single-family, owner-occupied, and residential. The only significant

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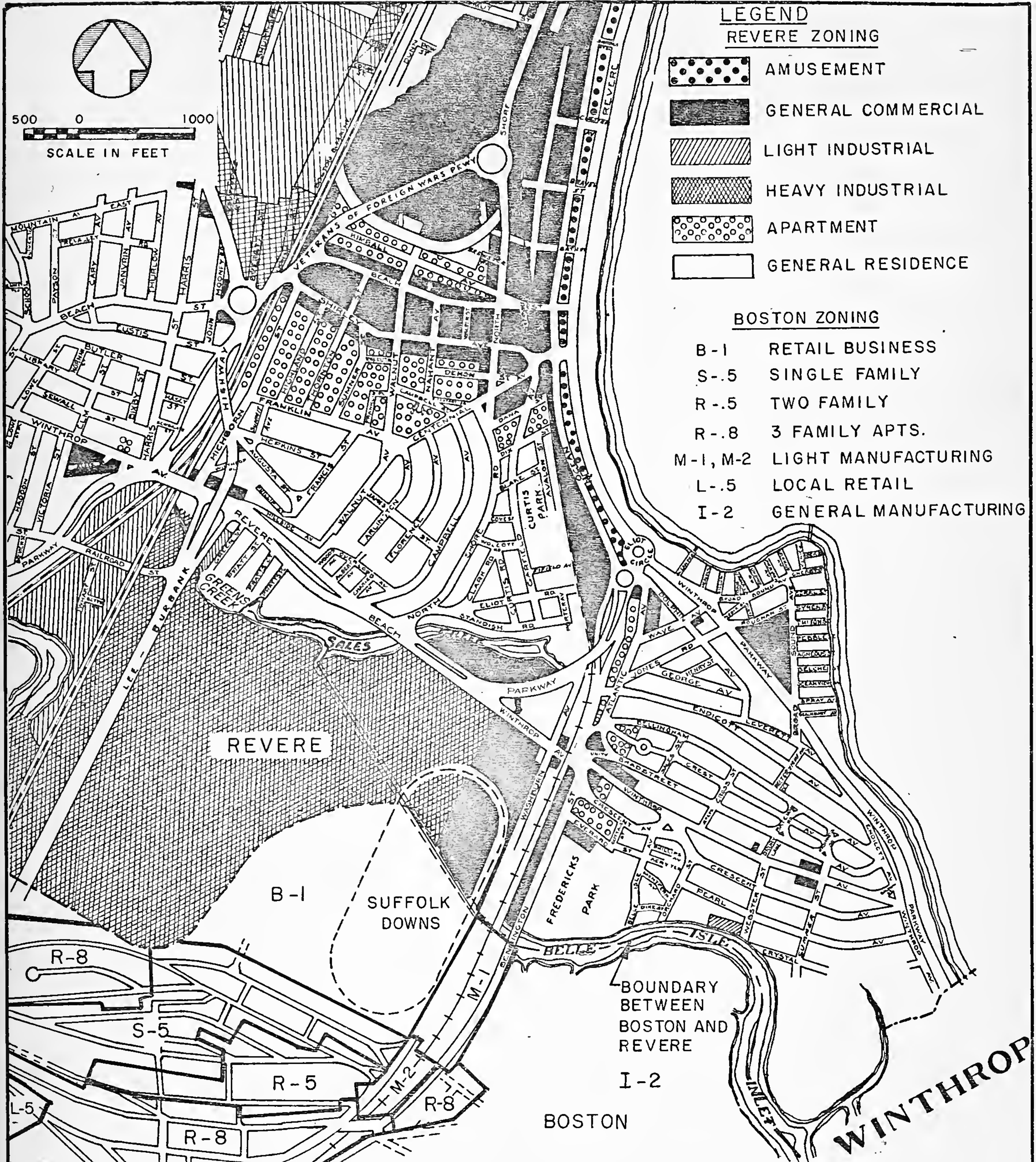
[1]See Section IIA1c for description of existing land uses in the watershed.



COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATERWAYS
ENVIRONMENTAL IMPACT REPORT • SALES CREEK • REVERE, MASSACHUSETTS

FIG. 8 EXISTING ZONING

public or semipublic ownerships are several public schools, churches, Crescent Beach, and Curtis Park.

c. Land Use at the Project Site. A discussion of land use and zoning of the project construction site by reach follows:

Reach 1

Sales Creek, from the Suffolk Downs horse stables and parking lot to the Belle Isle Inlet, flows through Suffolk Downs property which is zoned general commercial, heavy industrial, and retail business. Downstream of Suffolk Downs, the creek flows under the MBTA Blue Line tracks and the Bennington Street outlet structure. The surrounding land is zoned general commercial, general residence, and light manufacturing. Most of the land adjacent to the creek is open space.

Reach 2

Sales Creek, from the Revere Beach Parkway to the Suffolk Downs horse stables and parking lot, flows through open space land which is zoned heavy industrial.

Reach 3

South of this portion of Sales Creek, the adjacent land is zoned general commercial and is occupied by a supermarket and parking lot. North of Reach 3, the land is zoned general residence and is densely settled. A light industrial establishment is also located on the north side of the creek.

Reach 4

Reach 4, for most of its length, is a narrow drainage ditch which parallels the MBTA Blue Line tracks. West of the ditch, the land is zoned general residence. This land is also occupied by the Garfield School and Curtis Park. Most adjacent land in this area is open space. East of the ditch, the land is zoned general commercial. Adjacent on this side of the ditch are the MBTA Blue Line tracks. Just north of the drainage ditch, the land is zoned apartment.

Reach 5A

North of this portion of Sales Creek, the land is zoned general residence. Adjacent land just north of the creek is owned by the MDC, which uses it for disposal of street sweepings and miscellaneous rubble. The land south of this reach is zoned heavy industrial. Almost all of the adjacent land on either side of this reach is open space.

Reach 5B

Green's Creek flows through land zoned heavy industrial on the south and general residence on the north (a small strip of land northwest of the creek is zoned light industrial). An apartment complex and trailer park border the creek to the north, while several industrial buildings border the creek to the south.

Upstream of Lee Burbank Highway

For a distance of about 400 ft, just upstream of Lee Burbank Highway, a small ditch flows through open space which is zoned heavy industrial.

Further upstream the area is drained by an underground conduit. Almost all of the land is zoned general residence and apartment.

d. <u>Zoning and Land Use Controls</u>. The zoning ordinance of the city of Revere contains no unusual characteristics such as open space or conservation provisions, special restrictive covenants, or flood plain zones. Buildings must be constructed and inspected in conformance with the code, to obtain a Certificate of Occupancy. All uses must comply with setback provisions designed to separate and buffer one land use from another. All applications for variances or changes in zoning classification to permit a less restrictive use must go before the Planning Board; in addition, a public hearing must be held. A permit for a zone variance may be granted by the City Council, requiring a two-thirds vote of all council members, if the permit was not recommended by the Planning Board; a majority vote of all members would be needed, if the permit was approved by the board.

In addition, the code states that no such permit will be granted without first considering its effects on the neighborhood and the city. If a permit is issued with protective conditions, they shall be specified on the permit.

Some special provisions of the Revere ordinance should be noted. In both heavy and light industrial zoned areas, the use of land as a public or private dump or place of depositing abandoned property and refuse is specifically prohibited. This is especially important in the case of the Sales Creek/Belle Isle Inlet area, because historical dumping was responsible for changing channel configuration and blocking drainage or rechanneling. This

has resulted in some of the current drainage problems. However, much debris was observed in certain reaches of the creek, and illegal dumping may still be occurring.

Based on discussions with Revere and Boston officials, there apparently are no special local zoning or other restrictions which would affect the proposed project. Because the proposed improvements are being built by the Commonwealth in the interest of public safety and health, it is not expected that the improvements would be subjected to local (land use) zoning provisions under Chapter 40A.

e. Other Restrictions.

National Flood Insurance Program

The Federal Insurance Administration (FIA) under the National Flood Insurance Program has prepared a Flood Hazard Boundary Map for Revere. The map outlines special flood hazard areas.

A special flood hazard area denotes the outline of a base flood. A flood which reaches this boundary has a 1 percent chance of occurring each year, commonly referred to as a 100-year flood.

The degree of flood hazard is the key factor in determining insurance rates for specific properties within the area. However, the rate determination must await a Flood Insurance Study.

The result of the study would be a Flood Insurance Rate Map providing detailed information on the degree of flood hazard within identified Special Flood Hazard Areas, including flood elevation.

The study will probably begin sometime next year. (The city of Boston is currently being studied by Frederic R. Harris, Inc., Consultants, in order to provide the Flood Insurance Rate Map.)

Dependent on the effective date of amendments and the actual regulations adopted by Revere and Boston based on these new Flood Insurance Rate Maps, is possible that permits might be required by the Commonwealth prior to construction of the proposed improvements. This is provided the Commonwealth is found to be subject to the jurisdiction of local zoning.

Federal Water Pollution Control Act (PL92 - 500), Section 404

A U. S. Army Corps of Engineers permit would be required for the discharge of dredged material or of fill material into navigable waters in accordance with the following phased schedule:

a. Phase I: After the effective date of this regulation, discharges of dredged or fill materials into costal water and wetlands contiguous or adjacent thereto or into inland navigable waters of the U.S. and freshwater wetlands contiguous or adjacent thereto are subjected to the procedures of this regulation.

b. Phase II: After July 1, 1976, discharges of dredged or fill materials into primary tributaries, freshwater wetlands contiguous or adjacent to primary tributaries, and lakes are subjected to the procedures of this regulation.

c. Phase III: After July 1, 1977, discharges of dredged or fill materials into any navigable water are subjected to the procedures of this regulation.

After a 2-month moratorium, Phase II regulations became effective on September 2, 1976. These regulations in accordance with Phase II definitions would require said permits for at least a portion of the proposed Sales Creek flood control improvements. Additionally, under the same section of the act, a NPDES permit issued by the Federal Environmental Protection Agency would be required for the discharge of any "supernatant" water from the excavation.

U. S. Army Corps of Engineers Regulation 33CFR, 209.120
July 25, 1975

Any ocean dumping at the "fowl area" (discussed later) would require a permit from the Corps.

Marine Fish and Fisheries, General Laws Chapter 130, Section 27
Criminal and tort liability is provided for any agent or servant who permits the entrance or discharge into or on any part of coastal waters or tributaries of such waters, wastewater, heated effluent, or any other substance injurious to public health or tending to contaminate any shell fish area.

Massachusetts Water Pollution Control Act, General Laws, Chapter 692 (as ammended), 1972

Regulations covering hazardous wastes (appropriate to the wastes discovered in Sales Creek) adopted under authorization of this act cover all dredged spoil material except those subject to the U. S. Army Corps of Engineers' permit, after certification by the Massachusetts Division of Water Pollution Control.

Massachusetts Flood Plain and Wetland Zoning, Zoning Enabling Act General Laws, Chapter 40A, Section 2

In Massachusetts, the Zoning Enabling Act specifically permits municipalities to safeguard lands "deemed subject to seasonal or periodic flooding." The Act further states that these lands "shall not be used as to endanger the health or safety of the occupants thereof." Flood plain zoning, although designed primarily to prevent damage from floods, can permit use of low intensity recreation areas, while restricting urban development.

Conservancy Zoning, a device adopted in several Massachusetts towns, is essentially a variation of flood plain zoning, applying restrictions to periodically wet areas. This type of zoning restriction has not been specifically employed in the Sales Creek watershed.

Generally, the Commonwealth is not found to be subject to local zoning jurisdiction.

Massachusetts Wetlands Protection Act, General Laws Chapter 131, Section 40

This act controls, but does not ban, development on inland and coastal wetlands. Wetlands are defined here as inland wetlands (marshes, meadows, swamps bordering on rivers, streams, and ponds) or just about any land which is periodically wet. The law requires that any person or governmental agency intending to remove, fill, dredge, or alter a wetland must insure that the activity will have no adverse effect on water supplies, flood or pollution prevention, of fisheries protection. In effect, the owner must develop his wetland with the public's interest and safety in mind.

G.L. 131 Section 40 is applicable to the Sales Creek watershed. A joint hearing held by the Revere and Boston conservation commissions and their subsequent approval would be required prior to construction of any improvements.

Massachusetts Inland Wetlands Restriction Act, General Laws, Chapter 131, Section 40 A

This legislation supplements the regulative approach of the Wetlands Protection Act with a planning approach which does not depend on the landowner applying for a permit. The Commissioner of the Department of Environmental Management, to preserve and promote public safety, private property, wildlife, fisheries, water resources, floodplain areas, and

agriculture, is directed by this law to issue orders restricting development on inland wetlands. These orders are based generally on the adoption of flood plain mapping, regulations, and public hearings. Such flood plain orders have not been put into effect in the Sales Creek watershed.

Massachusetts Coastal Wetlands Act General Laws Chapter 130, Section 105

This act is similar to the Inland Wetlands Act. Because Sales Creek is no longer saline in any reach and the former salt marsh was filled in the 1930s to build Suffolk Downs, it is not expected that this act pertains to the proposed improvements.

Massachusetts Planning Enabling Act, General Laws, Chapter 40

The city of Revere Comprehensive or Future Land Use Plans. A 4-volume report was prepared for Revere in 1971 by Nash-Viger Inc. This report contains plans, recommendations, etc., which are used as a guide by the Planning Board, although it has never been formally adopted and, therefore, has no legal effect over the proposed project.

5. Economic Base Characteristics

Most people employed in Revere work in the services and wholesale and retail trade sectors of the economy, 81

percent of the work force or an estimated 5,057 individuals. Many Revere residents work in Boston or its suburbs. The Division of Employment Security estimated that the total number of persons over 16 in the labor force in July 1976 was 20,761 with 11.3 percent unemployment. The reported number of available jobs in Revere could only employ 30 percent of the city's labor force. Therefore, a minimum of 70 percent of the labor force work outside city limits (not adjusting for commuters who work in Revere and live elsewhere or for part-time jobs which makeup full-time equivalents). This comparison has been made to illustrate that Revere is basically a commuter suburb with about more than half its work force employed outside the city.

The MAPC has projected that by 1990 manufacturing in Revere would be reduced, while population is expected to increase. Thus, Revere's tax base would become more dependent on local residential property and sales taxes.

Annual operating costs for the city of Revere are approximately $30 million, which includes all funds and sources. Of this total dollar amount, approximately $18 million is collected from real estate, personal income, and direct taxes, and $1.4 million is collected from excise taxes. This total ($19.4 million) represented $456.47 per capita in 1974. (Sewer rates are collected

and paid as part of the general fund, and water is billed individually.) Complete 1975 data were not available.

The assessed tax rate in 1975 was $197.20 per $1,000 based on an estimated 28 percent of market value. This tax rate may change because of two factors. First, the state of Massachusetts has mandated that all property must be assessed at 100 percent market valuation. Secondly, Revere has not had a full reassessment in more than 25 years. Future tax rates will reflect both the need to comply with state law and total real estate tax dollars required to operate the city. Revere's 1975 tax rate converted to full or market value ($55.40 per $1,000) was exceeded by only 6 of the 23 cities in the Greater Boston area (within Route 495).

The most recent financial statistics published by the Boston Safe Deposit and Trust Co. (1974) indicated that Revere's moody rating[1] was Baa-1 and had a gross debt of $14,570,000 ($337 per capita). On a per capita basis, Revere's debt was exceeded by 7 of the 23 cities in the Greater Boston area.

Table 7 gives a summary of local government expenditures for Revere for 1976, including special appropriations. Total per capita expenditures for 1976 will be about $613.00, a 37 percent increase in 2 years. Special appropriations were made for emergency repairs of highway -

[1]Moody ratings are used to provide investors with a simple system of gradation by which the relative investment qualities of bonds may be noted. There are nine symbols which designate least investment risk to that denoting greatest investment risk. They are Aaa, Aa, A, Baa, Ba, B, Caa, Ca, and C. Bonds rated A-1 and Baa-1 are believed to possess the strongest investment attributes in their respective groups.

TABLE 7. SUMMARY OF 1976 CITY BUDGET FOR REVERE, MASSACHUSETTS[1]

Local Government Expenditures (Rounded to Nearest $100)

Area of Expenditures	Amount	Area of Expenditures	Amount
General Administration	$ 10,600	Police	$ 2,233,700
Appeal Board	2,300	Public works	1,569,700
Assessors/auditors office	180,100	Purchasing	190,600
Building	100,600	Solicitor's	122,600
City Clerk	94,400	Treasurer	879,400
City Council	54,200	Vets affairs	50,000
Collectors	98,100	Weights and measures	33,600
Conservation Commission and Council on Aging	4,400	Workmen's compensation	36,200
Election	75,200	Total I	9,087,600
Engineering	44,700	School department	11,329,500
Fire	2,385,000	Relief account	400,000
Health	145,100	Debt account	2,604,000
Library	135,300	Interest account	1,021,300
Licenses	15,400	Pensions/retirement	2,049,700
		Total II	17,404,500
Mayor	337,500	Total appropriate for all purposes (I and II)	26,491,500
Parks and recreation	257,500	Per capita appropriation[2]	$613.00
Planning Board	30,800		

[1]Includes all special appropriations to August 1976.
[2]MAPC population estimate used.

$24,300; initial and unexpected capital expenditures for water meters - $6,500; a police monitoring system - $12,000; and a new library roof - $5,000. Without these appropriations, however, per capita expenditures for 1976 would be $602 per capita, a 34 percent increase in 2 years.

The Revere budget has been presented to illustrate that:

1. Revere does not have a surplus of funds availability for flood control projects and/or drainage improvement.

2. Any future major improvements or flood control projects would probably require a bond issue, substantial state aid, or both.

3. Any operation and maintenance requirements for the Sales Creek Flood control project should be budgeted in advance of incurring the costs.

6. Archaeology, Paleontology, and Historic Sites

An extensive survey of the project site was made by a state archaeologist. The approximate full text of the archaeologist's report is presented in appendix H. A summary of survey findings is as follows:

No historic or prehistoric archaeological sites were found in this area in the course of literature or onsite searches. This lack of cultural resources is because of several factors: (1) Although historic and prehistoric people lived in this area, they did not live immediately in the marshes or estuaries but rather chose to live next to them. Previous surveys of similar areas suggest that sites will be found on rising ground

next to salt marshes or beaches but not in marshes[4]. Most of the project area is now or was in the recent past under water or marsh. Even the residential area north of Sales Creek (Reach 3) shows grey-brown mud resulting from frequent flooding of this area; (2) much of the project area has been filled to make it habitable, and a thick layer of dark coarse soils with much crushed rock, bits of construction materials, chunks of asphalt, bits of rusting metal, and pieces of china and glass cover the area. Most of the land south of Sales Creek and on both sides of Green Creek appears to be filled. This obscures any sites under a thick layer of refuse, although as mentioned earlier, testing has shown that the fill rests on marsh; and (3) there has been a great deal of disturbance in this area associated with previous construction and channelization. The one part of the project area which was not previously marsh or estuary the (narrow projection parallel to Revere Beach) lies next to the MBTA tracks. Any sites which existed there have been destroyed by that construction.

There are certainly paleobotanical resources here, in the form of plants and pollen in the peaty sediments of the marsh, but these resources are duplicated in many places in the Boston area. Such resources are also found in a far less disturbed condition elsewhere.

Furthermore, the National Register of Historic Sites and all updates published in the <u>Federal Register</u> were reviewed. Only one site, Slades Spice Mill, was found and would not be affected by the proposed project. A historical report, "Revere 100 years, 1871-1971," contained many potential

historic sites; however, these sites and buildings are not within the construction right-of-way of the project.

7. Aesthetics

The existing aesthetic features of the environment are in a deteriorated state. Floral diversity is quite low (see Section II.B.1); reed grass predominates along most reaches, overgrowing the creek banks and bottom. In some areas, the view of the creek is completely obstructed by this grass, which also tends to impede water flow.

The creek has been subjected to dumping and littering to a great extent over the years and, in some reaches, shopping carriages and automobile tires can easily be found. Pieces of wood, trash, and assorted debris are commonplace along the entire creek's length (except through the Suffolk Downs racing oval).

Grassy areas on Suffolk Downs property near the banks of the creek are usually maintained, providing a sharp contrast to the unkept creek banks.

The water in Sales Creek is aesthetically undesirable, because evidence of oil and grease were found virtually everywhere along its length. Stagnant and brackish pools of water often occur in the creek area, and mosquito control measures are necessary during the summer months.

Noise is an especially displeasing parameter. In at least one Sales Creek location near Bennington Street, noise levels (from traffic, MBTA

line, and overhead flight paths) sometimes exceed federal standards. Other monitoring stations report noise levels approaching federal standards.

Urbanization surrounding Sales Creek has contributed greatly to the creek's lack of aesthetic appeal and present deteriorated state.

In contrast, the Belle Isle Inlet is aesthetically pleasing, especially in the areas beyond the immediate urban encroachment near Bennington Street. A variety of natural marshland and plant and animal life proliferate in the Belle Isle Inlet area in contrast to the nearly homogeneous life found along Sales Creek.

III. ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

This chapter addresses the environmental impacts of the proposed project, consisting of beneficial and adverse impacts which might occur during and after construction (i.e., operational impacts). In addition, an attempt has been made to identify primary impacts (directly resulting from project construction and operation) and secondary impacts (indirectly resulting from project construction and operation). Impacts noted in this chapter relate to the proposed project outlined in the Engineering Report without the additional mitigation measures outlined in Chapter V.

A. Beneficial Impacts

1. Impacts During Construction - Primary

a. Population and Employment. Because Revere is located in a metropolitan area which has high unemployment, especially in the construction trades, the proposed project could benefit some of those who are unemployed. The total number of jobs created by the entire project could be about 85. Thus, the population impact to Revere during construction is expected to be minimal, although some residents might be employed by contractors working on the project. No significant change in Revere's total population is anticipated as a result of construction operations.

b. Primary Economic Impacts. Short-term economic effects would include increased personal per capita income in the metropolitan area from new employees. However, because of the relatively small costs involved compared to the size of the area, these effects would be slight.

The economic effects on Revere would also be slight, because most construction materials probably would be bought elsewhere, and probably few local employees would be hired.

c. Health and Safety. During construction, debris and muck deposited along the banks would be cleared. Rodent breeding areas would be eliminated by the replacement of old culvert structures.

2. Impacts During Construction - Secondary

a. Secondary Employment and Population. Service related employment might increase during construction. However, these jobs would be short-term and have a very slight impact on employment, if any at all. No significant population growth is expected to result from service jobs related to construction.

b. Secondary Economic Impacts. The economic impact created by service jobs during construction would be insignificant.

3. Impacts of Project Operation (After Construction) - Primary

a. Employment, Population, and Land Use. The project would create no significant permanent employment impacts for either the Revere community or the metropolitan area, although minor employment opportunities would be created for operation and maintenance of the facilities. Present industrial and commercial uses are not expected to change. Most newly planned projects in the area (school and park), which would create an impact by attracting people, are being built where drainage would not be significantly affected. While no past

surveys of actual flood damage costs have been located, they are considered to be substantial. The reduction and even possible elimination of such flood damage costs to both the city and private property owners would be a direct economic benefit. The utility of existing land would be improved because of lessened flooding conditions. Also, additional usable land would result from the proposed culverting of Reaches 3 and 5B, creating a greater opportunity for "green space" in the area.

b. Primary Economic Impacts. Property values, particularly housing, in the affected areas should increase because of reduced flooding frequency resulting from the project. These increased property values could result in increased tax revenue for the city. Reduced flood damage to homes and public facilities in the area could reduce future flood insurance rates to both property owners and the City of Revere. This assumes the city would adopt the recommended National Flood Insurance Rate Maps and accompanying regulations now in preparation.

c. Health and Safety. The primary benefit of the project's operation would be to reduce the frequency of flooding in low-lying areas. Such flooding now affects not only private homes, but also public schools and the operation of the street system in the area. A regular maintenance program would prevent accumulation of debris along the creek, thus, improving the aesthetic environment of nearby residences. Rodent populations would be reduced as a result of culverting and cleaning of trash and debris. In addition, reduced flooding conditions would improve driving safety during storms.

d. Water Quality. Because of the elimination and future prevention of debris accumulation along the creek, water quality would be improved. As noted in Chapter II, high levels of total and fecal coliform bacteria as well as sediments contaminated with oil, grease, and heavy metals found in Sales Creek suggest the presence of wastewater and other illegal discharges. Investigations of existing plans, conversations with local officials, and a visual inspection of the area did not yield definitive information regarding illegal discharges into the creek. Because levels rose during periods of rain, it is possible that combined wastewater overflows or direct sewer connections to drains exist. If the proper design and construction procedures outlined in Chapter V are followed, pollutant sources may be found and remedial action taken. Accordingly, water quality in Sales Creek and Belle Isle Inlet should improve after the proposed works become operational, provided that the channels and culverts are properly maintained.

e. Community Goals. Because a comprehensive plan has not been formally adopted for Revere, no public policies addressing the goals of the community exist. The completed project should improve the overall community (housing) image of the area, making a more attractive place in which to live.

4. Impacts of Operation (After Construction) - Secondary

a. Secondary Employment. No significant impacts because of secondary employment would occur from the project operation.

b. Secondary Economic. The alleviation of secondary costs (as

distinct from damages) incurred as a result of flooding (e.g., pumping out basements, cleaning up or replanting yards) would be a secondary economic benefit from the project.

B. Adverse or Problematic Impacts

1. Impacts During Construction - Primary and Secondary

a. Land Use, Visual Aesthetics, and Public Utilities. Work in many of the reaches would require construction easements, access roads to the channels, etc., which would inconvenience land owners and temporarily disrupt present land uses. No homes or businesses would be relocated, except possibly in the Reach 5B area. This reach is extremely narrow (4 ft), and house trailers are located adjacent to it on the northern side. The proposed culvert for this reach could be constructed just south of the reach (through a heavily debris-laden area and truck parking lot), to avoid relocation of trailers. Traffic might be inconvenienced but this impact is not expected to affect local businesses, providing that work at Suffolk Downs is scheduled for nonracing periods. The MBTA Blue Line service would not be severely affected, but service could be slowed down a bit because of two pipe jacking crossings. Visual aesthetics in the immediate construction area would be negatively impacted, but this short-term impact is considered minor.

Various public utilities (sewer, water, gas, electric, etc.) could be temporarily interrupted but with proper construction techniques, these disruptions would be very brief, if they occur at all. The major possibility for interruption would occur at the Revere Beach Parkway 84-in

culvert crossing. Potential disruptions (not all-inclusive because of the possibility of outdated plans) are:

<u>Revere Beach Parkway</u>

Two 10-in. natural gas mains

One 12-in. water main

One 14-in. water main

One 16-in. water main

One 24-in. water main

Two armored electric cables

As far as can be determined from existing plans, no utilities at the Revere Beach Parkway crossing[1] at the upstream end of Reach 3 nor at the pumping station's force mains' crossing at Bennington Street exist. Also, the MBTA has stated that no power or other MBTA conduits would be affected at the two pipe jacking locations under the Blue Line tracks.

There would be only minor energy costs involved normal to flood control construction practices.

b. <u>Health and Safety</u>. Unless precautionary measures are taken, serious flooding problems could occur because of culverts or portions of channels being out of service during a storm. This is a major impact, but it could be avoided by following construction procedures outlined in Chapter V.

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[1]If the assumed existence of a 48-in. culvert is incorrect, a new culvert crossing would be required (See IIA4a).

c. Topography, Geology, and Soils. The topography along the waterway would be altered because of the proposed excavation and filling operations. However, these operations would not significantly affect the area, because they would be contained within the banks of or adjacent to the creek. No problematic impacts on the area's geology are expected. Soil removal would be beneficial, because the soil is contaminated with heavy metals, grease, and oil. As noted before, sediments in Reaches 1, 2, and 5A and to a lesser extent in Reaches 3 and 5B are contaminated with high concentrations of heavy metals (iron, lead, and zinc), grease, and oil. Moderate concentrations of copper and chromium are also present in the sediment. These contaminants are for the most part locked up in the sediment matrix. Excavation operations would disturb the sediments, resulting in redissolution of contaminants into the overlying water. If not prevented, the natural drainage of Sales Creek could convey these contaminants to Belle Isle Inlet, where they would eventually precipitate out of solution.[1]

d. Biology.

Vegetation Impacts. The construction of drainage improvements could result in the loss of vegetation within a 50-ft zone of Sales Creek. The most common species to be removed is reed grass (Phragmites Communis), although in some areas (Reach 4), certain amounts of associated flora (cattails, smartweed, marigold, salt meadow grass) would also be removed. There is no anticipated impact to the vegetation

[1]Proper mitigation procedures for disposal of contaminated sediments are discussed in Chapter V.

of Belle Isle Marsh, either as a result of construction or operation of the system.

<u>Wildlife Impacts</u>. Construction of the Sales Creek drainage system would result in displacement of some wildlife. The number of birds (i.e., red-winged blackbird) utilizing the <u>Phragmites</u> for nesting would also be reduced in the immediate area. If regrowth of reed grass is precluded by management practices and mowed field plant communities result, a small increase in the number of passerine birds (i.e., robins, wrens) might be noted.

Whether the revegetation is reed grass or a mowed field, a relatively homogenous plant community would result. This community would have low diversity, offering little more favorable wildlife habitat than the area currently does.

No impact to wildlife on Belle Isle Marsh is anticipated from construction of the drainage system.

<u>Impacts to Fresh Water Organisms</u>. The limited benthic macroinvertebrate community along Sales Creek would be eliminated during excavation and other construction operations.

Removal of contaminated sediments in Reaches 1, 2, 5A, and 4 should provide more habitable substrate conditions. Generally, unless all pollution sources now entering the creek are found and rectified during design or construction, improved baseflow water quality, resulting from reductions of heavy metals, oil and grease, BOD, and an increase in DO, would periodically be overshadowed by slugs of contaminants from storm runoff. Therefore, recolonizing

organisms would still be pollution tolerant and facultative. Also, the recolonizing community would be limited in diversity and numbers by continually erratic changes in water flow conditions.

Except for some accumulations of silt inside the culverts, which might contain tubificid worms and midges, the culverted reaches would not contribute significantly to the benthic resources.

Impacts of Marine Organisms. The ultimately impacted resource area would be Belle Isle Inlet. Most impacts would be determined more by excavation and construction activities than by operation of the drainage system. With good "housekeeping" and ordered construction, impacts would be minimized. It is possible, however, that bacterial inputs might continue.

As previously documented, Belle Isle Inlet contains a substantive shellfish resource, a potentially good finfishery, and the only wildlife habitat of its kind in the East Boston/Winthrop area. Even with reasonable measures to minimize construction impacts, it is likely that some degradation of water quality would result. Impacts to the biota of Belle Isle Inlet could be produced by increased concentrations of heavy metals (particularly copper, zinc, and lead), increased levels of oil and grease (especially volatile fractions), increased amounts of suspended solids and BOD, and depression of DO levels.

The impacts of heavy metals and volatile oil fractions could be lethal to the infauna and epifauna, depending on the concentration.

Such an impact could be produced on an ebb tide, when dilution would be low. Sublethal impacts are also possible, particularly in deposit feeders (worms) and suspension feeders (clams). These impacts include the biological magnification of metals and chlorinated hydrocarbons which have potentially negative effects on enzyme activities, fecundity, and reproductive success. Significant inputs of oil and grease might clog gills; volatile oil fractions might be lethal to many biota. A depression of DO could also produce a synergistic effect.

e. Air and Noise Impacts

Air Impacts. The operation of construction equipment used during construction would be a source of air pollution. However, this contribution would be overshadowed by background traffic and stationary source emissions.

Excavation of sediment from Sales Creek is expected to produce a local short-term odor problem. Odor sources would be volatile petroleum fractions and sulfide contained in the sediments. It is difficult to predict the magnitude of the odors and how far from the excavation and disposal site they would be perceived. Construction operations in the area would cause excessive dust and smoke unless mitigation measures are taken.

Noise Impacts. Noise measurements made during field evaluations led to several observations for use in final planning and construction of the drainage works. First, ambient noise levels during daytime hours are at above FHWA standards, particularly at the Garfield School and the

Bennington Street area, near the site of the proposed Frederick's Park School. Attention should be given to work scheduling and use of equipment, to avoid undesirable noise levels during school sessions. Noise levels during construction of the proposed facilities would vary, depending on the type of equipment used. A range of 75 to 95 dBA probably would occur on an intermittent basis during construction.

f. Water Quality

Compliance with Water Quality Standards. During the course of stream excavation and construction of drainage structures, it is possible that some water quality standards would be temporarily affected. These effects, however, would be short-term and impacted parameters would return to background levels following construction.

While Sales Creek itself is classified B, its' general condition is C; and there are a number of parameters which, under present conditions, do not meet even class C standards. These parameters include: DO, oil and grease concentrations, coliform bacteria at some locations and at various times, and chemical constituents - particularly metals. Color and turbidity meet class B standards, but might be violated for a short period during construction.

As indicated in previous discussions, Belle Isle Inlet is classified SB, but its present condition is SC. The only two parameters, known to exceed class SC standards, are oil and grease and total coliform bacteria (apparently from wastewater or other illegal connections.)

During construction, there might be periodic (low tide), short-term, and localized alterations of class SB standards, such as DO, color, turbidity, and heavy metals.

Parametric Impacts. The excavation and construction necessary for the proposed drainage improvement in Sales Creek could adversely affect a number of water quality parameters. Measures to minimize these effects are addressed in Chapter V. Impacts to water quality might originate from physical disturbance of the sediment as well as from subsequent chemical reactions. The concentration of some parameters, therefore, would probably increase. DO, pH, and redox might be depressed temporarily as a result of excavation.

The sediment interstitial water contains the most immediately available forms of nutrients, minerals, metals, and gases. There are many chemical forms in this water which are dissolved or dissociated. Some metals might be in the reduced or oxidized form. There are also many ionized cations such as calcium, potassium, sodium, magnesium, and others as well as nutrients such as nitrogen compounds and phosphates. Upon disturbance of the sediment (e.g., by excavation), chemical forms in the sediment interstitial water are immediately available to the water column.

Physical disturbance of the sediment would generally account for increased levels of turbidity, suspended solids, oil and grease, and total coliform bacteria. Because the oil and grease component is present as an emulsion in the sediment interstitial water or is attached to organic and inorganic particles (e.g., detritus), it

would be released during excavation. In addition to fecal bacteria, the coliform group also includes soil bacteria. Disturbance of soil either from erosion or dredging could account for elevated concentrations of these bacteria which might not be directly related to fecal contamination.

Nutrient parameters would also be impacted. These include nitrate, nitrite, and ammonia nitrogen which could be affected by alterations or redox and an enhancement of ammonification, forming more ammonia nitrogen. Phosphorus would be released at increased concentrations from interstitial waters as well as through a potential reduction of the existing ferric phosphate complex to ferrous irons and soluble phosphate. An increase of organic and inorganic carbon would also originate from sediment disturbance and release of interstitial water.

Phenol is formed by the breakdown of hydrocarbons such as oil and grease, tannin and lignin contained in peaty sediments. This parameter is expected to show a spontaneous increase more from sediment movement and release from interstitial water, than levels derived from the longer-term decomposition of original compounds.

With the exception of a small amount of material at the sediment-water interface, the bulk of Sales Creek sediment is anaerobic.

Disturbance of this anoxic material would result in an increase of BOD and COD and a depression of DO, which could force anaerobic conditions on the base flow of water. The extent to which higher flows would be impacted depends on the water quality of such waters. Depending on oxygen concentration and redox condition of creek water during

excavation, insoluble metal-sulfide complexes could be broken by oxidation of sulfide. Depending on whether the reaction favored reducing or oxidizing conditions (and to what extent), the release of metals could be enhanced or suspended. Under such adverse water quality conditions as total anoxia and the presence of sulfide, many metals (mercury, lead, iron, magnesium, and others) would be bound as insoluble metallic-sulfide complexes (chloride and carbonate complexes could also exist.)

If oxidation of sulfide takes place, but anoxic conditions still prevail, some metals (i.e., iron and manganese) would be soluble. Other metals, such as mercury, lead, zinc, and copper, might be found as carbonate or chloride complexes or adsorbed to clay minerals. Under oxidizing conditions, iron and manganese would precipitate, with the iron forming an insoluble ferric phosphate complex. The release of copper and cadmium is directly related to oxidizing conditions.

Other metals, such as mercury, lead, zinc, and copper, might be found as carbonate or chloride complexes or adsorbed to clay minerals. Under oxidizing conditions, iron and manganese would precipitate, with the iron forming an insoluble ferric phosphate complex. The release of copper and cadmium is directly related to oxidizing conditions.

It should also be mentioned that the marine sediments of Sales Creek probably contain large amounts of sulfide and salt water, thereby enhancing the potential for sulfide and chloride complexes. Such complexes might prevail through Sales Creek, but, upon entering Belle Isle Inlet, the redox, pH, and oxygen levels would change. As Chen et.al.[5]

have recently published: "most trace metals, with the exception of silver, chromium, and mercury, were released under oxidizing conditions." Silver and chromium release does not correlate with any redox conditions, and mercury might adsorb to mineral particles and/or form chloride and other complexes.

Under ambient water flow conditions (base and storm flows), the aforementioned impacts to water quality might be expected to reach Belle Isle Inlet. Under ebb tide conditions, the impacts might be noted in at least the upper third of the estuary. Flood tide conditions would offer greater dilution. However, it is expected that the degradation of water quality would still be physically and chemically measurable.

2. Impacts from Operation (After Construction) - Primary and Secondary

a. Land Use and Aesthetics. Project operation would have no negative impacts to aesthetics, and land use potentials would be improved. To ensure adequate maintenance of the facilities, permanent easements might be required. The extent of these easements and the land use restrictions contained in them should be adequate to ensure access and to maintain the structural and physical integrity of the completed works.

b. Topography, Geology, and Soils. There would be no adverse impacts to the topography, geology, or soils in the area because of project operation.

c. Economics. The project is not being funded or subsidized by local funds. However, proper maintenance of the pumps and conveyance system, including bank areas, if performed by Revere Public Works, would increase costs to Revere taxpayers.

Currently, these costs are estimated to be about $5,000 per year. While no detailed estimate is provided for annual operational costs during flooding conditions, an additional $4,500 is suggested for budgeting by the city of Revere at this time for this contingency. This estimate could increase dramatically in accordance with the expected rapid rise in future utility rates.

d. Biology. Management of the Sales Creek drainage system would result in displacement of some wildlife. To preclude regrowth of reed grass in open drainage areas, management would be necessary. Rip-rapping of stream banks with stone would reduce the volume of plant regrowth, but mechanical or chemical management might still be required. On stream flanks, planting with grasses and periodic mowing during the summer should also reduce reinfestation with reed grass. The number of birds (i.e., red-winged blackbird) utilizing the *Phragmites* for nesting would also be reduced in the immediate area. However, if regrowth of reed grass is precluded by management practices and mowed field plant communities result, a small increase in the number of passerine birds (i.e., robins, wrens) might be noted. Whether the revegetation is reed grass or a mowed field, a relatively homogenous plant community would result. This community would have a low diversity and would offer little more favorable wildlife habitat than the

area currently does. No impact to wildlife on Belle Isle Marsh is anticipated from operation of the drainage system. No additional adverse impact is expected (above those which now occur from nonpoint sources of pollution) to the aquatic life of Sales Creek or Belle Isle Inlet, except that the aquatic community would be limited in diversity and numbers by continuing erratic changes in flow conditions and slugs of contaminants from storm runoff.

e. Air Quality and Noise Impacts. Periodic operation of pumps with gasoline or diesel driven engines during power outages would produce a small amount of suspended particulates, nitrogen and sulfur oxides. Total contribution from this source would not contribute significantly to existing conditions, and would be short term in nature. The Bennington Street area already exceeds FHWA standards during peak hours. If proper noise mitigations are followed (Chapter V) in the design of the pumphouse, the exterior noise levels should not exceed 73 dBA. This level would not add significantly to the existing 77.5 dBA level.

f. Water Quality. No adverse or problematic impacts are expected to directly result from project operation.

g. Availability of Services. The project would have no adverse effects on the area's growth or the availability of services.

h. Public Support. Existing documentation for public support of the project, demonstrates that:

1. Drainage improvements are needed; it is understood that

many letters have been written to the state Senator from the district and the Massachusetts Division of Waterways in an attempt to solicit support.

2. A basic community value, that of living in a safe, clean neighborhood, would be reinforced by implementation of the project.

i. Other Considerations. As stated before, no adverse or problematic impacts to water quality are expected to result from project operation. However, there is circumstantial evidence that the creek is currently being polluted by petroleum products from the petroleum tank farm and/or parking lots, illegal sanitary sewer discharges, and animal wastes, based on water quality testing. Measures to alleviate this problem are discussed in Chapter V.

IV. ALTERNATIVES TO PROPOSED PROJECT

The Engineering Report did not include a discussion of potential alternatives to the proposed project (presumably because these considerations were not in the scope of work). There are a number of potential alternatives to the proposed project, and consideration was given to them as part of this report. Three potential alternatives which were given initial consideration but deemed not worthy of further study were (1) diverting flow from the Creek to the Roughan Point pumping station; (2) pumping flow from Sales Creek into Broad Sound; and (3) connecting Sales Creek drainage to facilities developed for the proposed Alba Corporation Revere Beach Redevelopment Project. These are discussed as follows:

1. Diverting the flow from Reach 4 and the Beachmont area to the Roughan Point MDC pumping station would require a new pump station and force main at Reach 4 and complete renovation of the Roughan Point pumping station including new pumps and possibly a completely new structure to house the pumps. In addition, an ocean outfall would be required (the Roughan Point pumping just discharges on the ocean side of the sea wall). The economics of pumping the same flow at two pumping stations (Reach 4 and Roughan Point) in lieu of pumping the storm flows once as proposed at Reach 1, as well as the construction of a large diameter and lengthy ocean outfall would clearly prohibit this alternative.

2. Discharge of Sales Creek drainage across Short Beach or Crescent Beach and into Broad Sound was not considered because in order to prevent a degradation of the SA classification of this area and allow continued recreation at these beaches, a large diameter ocean outfall would also be required.

3. Rerouting Sales Creek drainage to drainage facilities developed for the proposed "Alba Corporation" project, north of the study area, was not considered since preliminary engineering plans indicate that only a small portion of this project will be within the watershed. Drainage from this small area presently drains to Reach 4 and preliminary plans for the Alba Project indicate that this drainage pattern will continue.

Since these three alternatives were disgarded as not sound from an engineering standpoint, no resulting environmental impacts were studied.

A. Chelsea River Alternative

1. Description of Alternative

A fourth potential alternative--rerouting Sales Creek drainage to the Chelsea River--appeared to be possibly competitive with the proposed project and accordingly was given consideration.

In order to reroute Sales Creek drainage to the Chelsea River, the direction of flow in Reaches 1, 5A, 5B, and part of 2 would be reversed. The preliminary improvements required to implement the alternative are shown on Plate A (Appendix A) and described below. It must be emphasized that this alternative was not investigated in the detailed manner in which the proposed project was studied in the Engineering Report.

For this alternative, the Bennington tide gates would be closed, and three new 5-foot diameter (approximate) culverts would be installed along Reach 1 (instead of the three larger culverts proposed in the Engineering Report). The proposed 60-in. culvert under the MBTA Blue Line would not be required. In addition, a 96-in. diameter (approximate) culvert would be installed in reach 5B (in place of the proposed 66-in. culvert in the Engineering Report) and continued across the Lee Burbank Highway, westerly on Railroad Street under existing Boston and Maine railroad tracks, then southerly parallel to the tracks to a new 300-cfs pumping station and tide gate structure at the Chelsea River. Other improvements recommended for the proposed project would be the same except that Reach 5A may have to be excavated to elevations -1.0 to -1.7 (as opposed to elevation -1.00 to +1.30 for the proposed project).

If this alternative were to be implemented, a complete engineering investigation would be required to ensure feasibility, ascertain proper culvert sizes, invert elevations, wet well requirements at the pumping stations, land availability, and ownership, etc. It must be repeated that the culvert sizes and routings mentioned above are only preliminary.

2. Environmental Impacts of the Chelsea River Alternative

a. Beneficial Impacts. The beneficial impacts outlined in chapter III (health and safety, water quality, employment, economics, etc.) also would apply to the Chelsea River alternative.

b. Adverse Impacts. From a preliminary engineering standpoint, it appears that rerouting drainage to the Chelsea River would be in the

order of 20 percent more expensive than the proposed project based on present day cost estimates. Since this alternative project would require a new preliminary engineering report prior to design, project construction would be delayed, thereby resulting in even higher comparative costs during an inflationary period.

From a land use and public utility standpoint during construction, traffic will be inconvenienced on the Lee Burbank Highway in addition to the Revere Beach Parkway (proposed project). Also, the larger size culvert in Green's Creek needed for the alternative may result in more significant relocation problems than for the proposed project. In addition to possible temporary utility disruptions in Revere Beach Parkway, uses of utilities in Lee Burbank Highway (1-10 in. water main, 1-12 in. water main, and 1-12 in. storm drain) also could be disrupted during construction. However, additional adverse impacts are not considered, by themselves, significant enough to eliminate consideration of the alternative project.

With regard to soil impacts, the possible discharge of heavy metals, grease, and oil locked up in creek sediment would probably have less affect on the Chelsea River than on Belle Isle Inlet, primarily due to higher dilution capability and the lower classification of the Chelsea River (the Chelsea River is classified SC, and the Belle Isle Inlet is classified SB). Proper mitigation procedures for the disposal of contaminated sediments and the minimization of pollutant discharges during construction are discussed in Chapter V.

Impacts on the benthic and fishery resources (marine organisms) of Chelsea River have not been documented but are estimated to be minimal. The

history of water pollution in this waterway is the major deterrent towards creating a significant biological resource. Since the resources of the Chelsea River have not been documented, the impact of heavy metals, oil, and grease on the marine organisms cannot be definitively stated, but it is reasonable to assume that these impacts would be less than in Belle Isle Inlet because of the lower Chelsea River classification and increased dilution potential.

With respect to water quality and water resources, as noted above, the classification and condition of the Chelsea River is SC. From the information that is available (Boston Harbor Survey: Massachusetts Division of Water Pollution Control; 1972), Class SC standards have been violated by low dissolved oxygen levels and high concentrations of total coliform bacteria. Information is not available on concentrations of heavy metals, oil, and grease. However, by the appearance of the water and the River bank (which has a coating of oil and tar approximately 0.25 inches thick in some locations), it is a rather safe assumption that the limit of 15 mg/1 oil and grease is at least periodically violated. The extent to which water quality standards would be effected in Chelsea River would be less than in Belle Isle Inlet, primarily due to its lower classification and higher dilution capacity.

B. No Build Alternative

1. Beneficial Impacts

If the proposed project or the Chelsea River alternative were not constructed, the adverse impacts during construction such as noise, traffic

inconvenience, etc., would be eliminated. In addition, the possible short-term impact of sediment pollution (during construction) entering the Belle Isle Inlet or Chelsea River would be eliminated.

2. Adverse Impacts

a. Health and Safety. The most significant adverse impact for the "no build" alternative would be the continued flooding problems outlined previously. These problems affect about 700 homes in addition to the Garfield School, Our Lady of Lourdes Church, Suffolk Downs, and other facilities.

In addition, the no build alternative would probably result in a continuation of rodent breeding areas, and debris filled channels which can cause significant health and safety problems.

As noted earlier, illegal piped and overland flow connections to the Sales Creek drainage system are suspected. This causes a deleterious affect on Belle Isle Inlet which would continue if the project is not constructed or a special survey including remedial measure is not undertaken. Thorough design investigation should reduce, if not eliminate, these occurrences the future.

Many of the existing culverts in the area are in extremely poor structural condition due to corrosion and settlement. If no action is taken, these culverts will continue to deteriorate and eventually collapse which could cause severe property damage, personal injury or loss of life, and no flood protection at all for facilities upstream of the culverts.

For the above reasons, the "no build" alternative is not considered viable.

C. Defer Improvements

1. Beneficial Impacts

At present, there are no known beneficial impacts of deferring the improvements.

2. Adverse Impacts

Deferring the improvements would result in a continuation of the flooding conditions, rodent problems, possible illegal connections to the creek, and a continued structural deterioration of the culverts, as outlined previously. This alternative is not considered viable.

In addition, the project cost will undoubtedly increase if the project is delayed.

D. Recommendations

The major adverse impacts of the proposed project or the Chelsea River alternative will occur during construction when sediment is disturbed. As will be noted in Chapter V, if proper mitigation procedures are followed during construction, any impact to the Belle Isle Inlet will be temporary and probably will affect only the upper third of the estuary.

Even though impacts to the Chelsea River would probably be less significant, this alternative is not recommended because it is more costly, will delay the project, and, after a thorough engineering investigation, may be less feasible than now considered.

V. MINIMIZATION OF DAMAGE TO THE ENVIRONMENT

This chapter outlines measures which could be used to mitigate the potential adverse impacts of the proposed project and also outlines adverse impacts considered unavoidable. The chapter is divided into four sections; (1) mitigations prior to construction, (2) mitigations during construction, (3) mitigations after construction, and (4) unavoidable adverse impacts.

A. Mitigations Prior to Construction (During Final Design)

1. Water Quality

a. Pollution Sources. As noted previously, there is reason to suspect that some point source pollutants may be entering the Sales Creek drainage facilities. While no specific sources have been found to date, it is recommended that during design, a detailed survey of the watershed be made to locate and identify all conduits entering the creek, and to ensure that these facilities transport storm drainage only. Any facilities which are found to contain pollutants should be identified and remedial separation measures designed.

The detailed survey of the area should include dye tracing, water quality analyses of suspicious conduits discharging to the creek, and surcharging of existing sewers (through hydrant flushing if possible) to identify

possibly combined sewer overflows.

Any illegal facilities now entering reaches which are to be enclosed in culverts should be readily identifiable during construction since they would have to be physically connected to the new culverts. The detection of illegal connections in reaches that are proposed to remain open channels will be more difficult. In this regard, not only should any illegal pipe connections be located, but possibilities of overland flow or runoff needsalso to be examined, particularly in the Suffolk Downs and petroleum oil tank farm areas of the watershed.

During final design, it may appear desirable to enclose other reaches in culverts, thereby making future illegal connections more difficult. This should be considered by the design engineer and brought to the attention of the agency seeking the design services.

Care should be exercised in not employing contaminated excavation materials from Sales Creek for surface bank fill where storm and overland runoff into the open watercourse will cause contamination of the water in the creek.

Similarly, evaluation of the cost of the alternative construction techniques, such as employing piling versus excavation and fill methods should take into account any possible pollution of the channel area by leaving existing contaminated materials in place.

In addition, proper grading and seeding of the side slopes and rip rapping of the channel bottom would enhance water quality potentials as

well as improve visual aesthetics.

2. Health and Safety

a. Culverting Existing Open Channels. During the final design phase of the project, care must be taken in the design of culverts to replace the open channels in Reaches 3 and 5B.

One of the major considerations during design would be the future use of the filled-in channels. In particular, much of the land south of Reach 3 is a parking lot. If this parking lot extended over the filled-in Reach 3, the conduit construction material and the type of backfill selected will have to be specified to handle anticipated loads. In particular, culvert and pipe materials must be chosen of a strength sufficient to accommodate the proposed use of the land above. Similarly, the structural strength of soil excavated from the existing Sales Creek is questionable for support of any occupied use of the land.

Care should be exercised during the final design phase to take a large enough permanent easement or right-of-way to not only assure access for proper maintenance purposes but also to create a publicly-maintained green space or open watercourse area. Public maintenance responsibilities should include grass cutting and bank cleaning as well as debris and sediment prevention and control.

The next section of this chapter is concerned with measures which should be taken during construction to minimize damage to the environment. It should be noted that some of the items mentioned will require proper

engineering input during design (in particular, sediment disposal, bulkheading channels, etc.) in order to effectively implement the mitigation measures.

B. Mitigations During Construction

1. Physical Mitigations

a. Excavation Techniques. Since excavation operations would agitate contaminated channel sediment, resulting in resuspension of heavy metals, grease and oil, special precautions should be taken to minimize the flow of these contaminants into Belle Isle Inlet.

Bulkheads should be used to the maximum extent feasible to control and minimize the release of the contaminants contained in the creek sediment as well as the sediment itself. The intention would normally be to bulkhead the upstream and downstream sections of the reach being excavated. The bulkheaded reach would serve as a holding pond, allowing resuspended contaminants to settle out and be subsequently removed. The bulkheads should be high enough to obtain a maximum detention time for the distrubed water, but low enough to allow reasonable storm water quantities to flow over the top of the bulkheads without undue flooding of adjacent areas. From a preliminary engineering standpoint, perhaps 3 to 4 feet of vertical depression of the top of the bulkhead below the top of the adjacent stream banks would be sufficient.

Periodically, as the water level rises in the bulkheaded reach, the downstream bulkhead would be allowed to drain slowly to allow easier

construction and provide storage for low volume rain storms. Construction in the reach should halt several days before the bulkheads are removed to allow maximum settling time with subsequent cleanup of the last sediment prior to bulkhead removal. The ideal situation while construction is proceeding would be to drain the reaches on Monday morning or after holidays, etc.

Hay bales could also be used across the downstream reaches to remove any additional suspended oil and heavy metals attached to sediment while draining of the bulkheaded reach is occuring. If possible, the reaches should be drained when the tide starts to ebb, or the pumping station used for dewatering during high tide, so that the discharge to the Belle Isle Inlet would be gradual and maximum dilution obtained. Hay bales would probably not be advisable during rainstorms since they may aggravate flooding problems. However, during storms, the contaminants will be diluted, thereby reducing any impacts to the Inlet.

It is recommended that the water quality near the Belle Isle Inlet be monitored during excavation operations so that operations can be suspended and remedial measures taken if the water discharging to the Belle Isle Inlet becomes undesirably degraded. Also, chemical addition to the water may be required to flocculate and settle out resuspended contaminants.

It is suggested that after the pumping station is constructed, culverts in Reaches 1 and 3 (under the Revere Beach Parkway only) be installed before work proceeds on other reaches so that creek drainage will be

maximized. In general, it is recommended that the remainder of the work proceed from upstream to downstream to prevent contaminants from settling out in excavated downstream reaches.

In order to allow maximum detention capacity in Reach 3, it is suggested that the proposed 84-in. culvert be installed on one bank of the existing channel. After the culvert is installed, the rest of the channel could then be filled in.

It should be noted that other, more expensive control measures such as temporary bypass canals might be considered to control suspended sediment release even more. These should be given thorough consideration and analysis during final design.

It is preliminarily estimated that bulkheading the channels might cost in the order of $85,000 (anticipated October 1977 cost). This cost is based on five bulkheads (at the downstream ends of Reachs 2,3,4,5A, and 5B). No bulkheads would be required on Reach 1 since the tide gates could be closed during work on this reach and opened periodically as required.

b. Excavated Spoil Handling and Disposal Facilities. Based on excavating the channels to the proposed inverts, the spoil volume is estimated to be in the order of 13,000 to 15,000 cubic yards. It is possible that contaminated sediment exists below proposed inverts in which case the spoil volume may be a bit higher. As noted before, Reaches 3 and 5B are to be enclosed in culverts. Accordingly, these

reaches may require additional excavation and perhaps some structural backfill to support the culverts adequately. Alternatively, these culverts may be supported on piles. If piles are not selected, the excavated spoil volume could be about 23,000 to 25,000 cubic yards. If excavation well below the proposed inverts is required for Reaches 3 and 5B, it is not anticipated that much of this soil will be heavily contaminated. Accordingly, its disposal does not warrant special mitigation procedures.

Because of the polluted nature of the 13,000 to 15,000 cubic yards of sediment in Sales Creek, specific attention has to be given to its disposal. A number of possibilities were considered including:

(1) Ocean Disposal
(2) Disposal at Land-fill areas
(3) Diking, On-site
(4) Burial of the Spoil On site

Disposal of the dredged material at a Foul Area (operated by the U.S. Army Corps of Engineers) 22 nautical miles outside of Boston Harbor poses problems. The closest to the work area a barge could navigate would be either Chelsea Creek or the Belle Isle Inlet at Saratoga Street, in Winthrop. This may require handling of the sediment several times, thereby adding to the cost. The polluted nature of the sediment also makes ocean disposal, even though at a Foul Area, not as environmentally acceptable as other alternatives. It is questionable if the poorly consolidated sediments would sink rapidly enough to prevent large-scale

dispersal and contamination of the surrounding water, particularly with regard to oil and grease. In order to dump at a Foul Area, a permit from the U.S. Army Corps of Engineers, with state and EPA approval, is required.

Even if a bulk sediment chemical analysis were performed on the material, there are no guidelines at present as to whether such a permit would be granted. (Although it is stated that an "Elutriate Test is necessary for permit consideration" (6)). The estimated cost of barging 15,000 cu. yd. of spoil is $190,000 (estimated October 1977 cost).

Disposal of the sediment at a landfill would probably be allowed by the Massachusetts Division of Water Pollution Control, but provisions would have to be made to cover the material daily.

The closest landfill would be Peabody, but this facility reportedly may not have adequate capacity. A landfill in Tyngsboro would be the next nearest location. Transportation costs to these sites in closed containers (to prevent leakage on highways) and the number of trips involved for the estimated 13,000 to 15,000 cubic yards would be very high.

Disposal of sediment on site can be conducted by burial below grade. Diking was also considered but due to the cost involved with treating diked effluent, and the future use or disposition of the diked area, this solution was considered undesirable. Instead, excavation of a suitable area and burial of the sediment on-site appears most ecologically and economically feasible (provided that land can be obtained at a

reasonable cost) and is recommended. Since there appears to be adequate land area available essentially on-site, off-site locations for diking or burial were not considered.

Burial of the estimated 15,000 cubic yards would require an excavation of about 3 to 4 acres, 4 feet deep (to be above the high water table). This depth would allow for at least one foot cap.

The disposal pit should be excavated as required to avoid having a large excavation which would fill with water and result in contaminated runoff to the creek. In addition, all excavated sediment should be covered over daily.

Before the spoil is placed in the pit, tests to determine the consolidation characteristics of the spoil should be performed. If the tests indicate that the spoil does not readily consolidate (i.e. the spoil will stay in a soupy state), it would have to be mixed with sand (or the excavated material from the pit, if suitable) in order to structurally stabilize the spoil. If this is required, tests would have to be done to determine the proper mixing ratio. Depending on the consolidation test results, the required pit area may be larger than 3 to 4 acres, but in any case adequate land appears to be available for a larger pit.

A potential site, just south of Reach 5A, is owned by Ogden Leisure, Inc. (the proprietors of Suffolk Downs). The pit disposal estimated cost is \$100,000 to \$130,000 depending on size. These costs (October 1977) include excavation costs for pit and an allowance for engineering

and contingencies, but exclude land costs and the cost of disposal of material excavated for the pit and lagoon, which probably can be used nearby and accordingly is considered minor.

The material that would be excavated to form the disposal pit is comprised of miscellaneous fill which could possibly be used:

1) for project backfill;
2) along the northern side of Reach 5A (MDC land);
3) at the proposed Fredericks Park school site;
4) on the site of the abaondoned drive-in next to Belle Isle Inlet (in order to raise the proposed park site above high tides);
5) for mixing with dredged spoil if spoil will not consolidate.

As indicated in the discussion on Parametric Impacts (Chapter III), the excavation operations on Sales Creek will produce an increase in suspended solids, metals, oil and grease, nutrients, BOD, bacteria, carbon dioxide, and a depression of dissolved oxygen. The impacts to water quality, however, will be short-term. Once the excavated material is disposed of in the excavated pit, equilibrium conditions will return. The oil and grease which for the most part will be attached to resuspended organic and inorganic particles, is expected to decrease in concentration as settling time continues. The presence of oil on the sediment also tends to reduce problems with any polychlorinated biphenyls (not specifically tested for, but from experience they may be present), since sedimented oils have been found to concentrate these non-polar compounds. If the oil and grease situation can be handled effectively,

the potential problems with chlorinated hydrocarbons will be minimized. Oil and grease contained in water, leaching through the bottom and sides of the excavation will be entrapped in the soil and will be adsorbed to clayey and peatey soils. In sandy or coarse soils, heavy metals will build up in the soil interstices and could eventually enter the waterway but in very low concentrations.

Heavy metals will be sequestered in a number of ways. Adsorption to soil and old peat deposits under and around the disposal site will be as important as a number of chemical reactions. After deposition and covering of the sediment, all the soil will be anaerobic and sulfide reactions will take place. The formation of the sulfide is important because such metals as mercury, lead, iron, manganese, and others will form a sulfide complex. The complex is insoluable and will bind the metals in the sediment. Under reducing and anaerobic conditions, formation of chloride complexes, and organic-metalic complexes will also affect the concentrations. The release of copper is directly related to increasing oxygen concentrations and cadmium may be significantly released only under oxidizing conditions. A significant change in concentration of chromium, however, has not been found under any redox conditions (7).

The presence of anoxic conditions, therefore, is very important in limiting the release of metals from sediments. Additionally, by burial of the sediments in the soil on the site, the release of pollutants will be effectively minimized.

If the pit is excavated gradually, there should be no runoff directly from the pit to the creek. However, if for some reason runoff occurs, a holding pond could be excavated adjacent to the pit and the effluent treated to reduce the metal content. Application of sodium sulfide to form a sulfide complex, or the use of activated carbon has been found effective. The dosage rate of sodium sulfide is determined stoichiometrically in accordance wtih metal concentrations to be treated. Additionally, depending on the level of metals to be removed, the dosage of activated carbon may range from 5000 ppm to 10,000 ppm.

The vegetation near the proposed pit will be lost temporarily. These areas contain relatively unproductive abandoned field plant communities. This plant community type is self-renewing unless specifically seeded with other species. Therefore, the net loss of vegetation would be negligible.

c. Highway Crossings. Excavation for the pipe crossings at the Revere Beach Parkway and Bennington Street, would consist of open trenches. Excavation should proceed so that traffic disruption will be minimized although inconveniences during rush hours will probably result. It may be wise to advertise in local newspapers before work is begun and alternate routes suggested. After construction, the trenches should be filled and resurfaced with suitable material that will restore the highways to their near original condition.

d. Air Quality and Noise. As noted in Chatper III, excavation of sediment from Sales Creek is expected to produce a local short-term

odor problem from volatile petroleum factions and sulfide contained in the sediment. If a serious problem with sulfide should develop, odor production might be mitigated by incorporation of agricultural lime to adjust the pH. Should petroleum odors be the problem, the addition of potassium permanganate ($KMnO_4$) would greatly reduce the odor level. (Recent investigation into odor abatement practices found that a kerosine-like odor was consistently removed by the $KMnO_4$ treatment).

Another factor contributing to decreased air quality from construction would be the addition of soil dust to the atmosphere. Dampening soil during the construction phase will reduce fugitive dust. Water with calcium chloride or other non-polluting dampening substances should be used. Dampening loose soil should be done on a scheduled basis in order to ensure minimal atmospheric input of soil dust.

Immediate revegetation of the disturbed soil will hasten soil stabilization resulting in less windblown dust.

During periods of high wind, suspension of those construction activities that generate high dust levels will mitigate deterioration of air quality. Properly maintained equipment will reduce exhaust contaminants from construction vehicles, equipment, and the pumping station emergency gasoline engines.

Properly maintained equipment and vehicles with noise control devices will reduce noise levels during the construction phase of the project. Consturction during daylight hours will minimize disturbance to individu-

als in nearby residential areas. Proper noise attenuation equipment for the pumping station emergency gasoline engines will prevent any significant increase to the already high peak ambient noise (77.5 dBA).

e. Water Quality. The primary mitigation procedure for protecting the water quality would be the excavation operation procedures (or comparable ones) mentioned previously. Also, the amount of sediment entering the creek will be reduced by loaming and seeding and/or riprapping the creek's banks. Sediment inflow will also be reduced by dampening loose soils at the time of construction. The use of portable chemical toilets during construction will prevent any possible contamination from sewage.

f. Land Use Mitigations. The marsh at the opening of Belle Isle Inlet is the only sensitive area in a natural condition near the project impact area. Since no work is being done at the Inlet, there are no mitigation procedures required for its protection other than those recommended in other sections of this chapter.

Due to the lack of scenic views in the area, no special mitigation measures are recommended other than those normally taken during construction projects to reduce dust and smoke.

Enforcement of the anti-dumping code with harsh penalties and patrolling would help ensure that the improvements are as rewarding as possible and would improve the environmental quality of the area. Permanent easements restricting future building along the Sales Creek stream banks or over proposed culverts should be acquired. Perhaps, an addi-

tion to the Zoning Code would help to ensure protection of stream banks.

2. Biological Mitigations

a. Protection of Aquatic Life. In order to protect Belle Isle Inlet from further contamination caused by resuspension of heavy metals and grease and oil during excavation operations, the procedures discussed previously should be instituted. Revegetation of denuded areas will help retard erosion and sediment accumulation in Belle Isle Inlet.

b. Revegetation. Prompt revegetation of disturbed areas will reduce the potential for soil erosion and restore damages incurred during construction.

3. Social Impact Mitigations.

a. Construction Equipment. During construction, heavy equipment should be securely locked, and stored construction materials on site protected (fenced) to prevent accidents. Construction could be timed in such a manner as to cause the least impacts to traffic and thus to citizen's schedules.

b. Archaeology, Paleontology and Historic Sites. Although no sites are expected to be found during construction, work crews should be warned that they might encounter cultural remains while digging. If remains are found, Chapter 1155 of the Massachusetts General Laws requires that such finds be reported to the State Archaeologist for recovery.

C. Mitigations after Construction

1. Health and Safety

In order to ensure the functional integrity of the completed works, periodic maintenance of the facilities will be required. Maintenance should include inspections of the pumping station and appurtenant controls, stream channels and culverts. Since the velocity in the channels and culverts will not normally be high enough to obtain self cleansing, periodic cleaning of the silt deposits will probably be required. If proper operation and maintenance procedures are not followed, the facilities will deteriorate with time and present flooding problems will return.

2. Water Quality

Periodic testing of the Sales Creek effluent might be appropriate to ensure that combined sewer overflows or other illegal discharges do not occur.

D. Unavoidable Adverse Impacts

1. Water Resources and Aquatic Life

There may be unavoidable adverse impacts to Belle Isle Inlet resulting from excavation operations. As previously discussed, the excavation operations would cause much sediment to resuspend. Attached to the sediment would be the contaminants (heavy metals, grease, and oil). If proper precautions are taken, much of the heavier sediment particles

could settle out, and many of the finer particles could be filtered out by the hay bales. However, if the creek water and sediment (which is historically of a marine nature) is aerobic, some heavy metals could redissolve and reach Belle Isle Inlet. As noted in Chapter II, most of the creek water has marginal dissolved oxygen concentrations. Having reached Belle Isle Inlet, the dissolved heavy metals may react with the high chloride concentration to form insoluable chloride complexes which would settle out and adversely affect benthic organisms (clams would not be affected since they are suspension feeders). If the creek water and sediment is anaerobic, and sulfides, carbonates, or chlorides are present, the heavy metals would remain insoluable. However, there is a possibility that some insoluable heavy metals would flush into Belle Isle Inlet despite precautions taken to prevent occurrences (e.g., a significant storm would flush the creek during excavation operations). Having reached the Inlet, the insoluable metals would oxidize (due to the aerobic nature of the Inlet's water) and be redissolved. Some of the dissolved metals would be eventually flushed out of the Inlet due to wave and tide action. However, most of the dissolved metals may react with the chlorides and form insoluable complexes which would settle out.

The impacts of heavy metals and volatile oil fractions could be lethal to the infauna and epifauna depending on the concentration. Such an impact could be produced on an ebb tide when dilution would be low.

Sub-lethal impacts are also possible, particularly in the deposit feeders (worms) and the suspension feeders (clams). These impacts include the biological magnification of metals and chlorinated hydrocarbons which have potential negative effects on enzyme activities, fecundity and reproductive success. Significant inputs of oil and grease may clog gills; volatile oil fractions may be lethal to many biota. A depression of dissolved oxygen could also produce a synergistic effect.

Unless a catastrophic event occurs, or no care is taken during construction, it is unlikely that the contribution of sedimentary materials from suspended solids would equal the annual sedimentation rate in the estuary. The input of suspended solids under reasonable conditions will be insufficient to bury or suffocate the benthic biota. However, it is possible that shellfish tissue might be affected by hydrocarbons from oil absorbed to fine detrital particles; and that heavy metals may affect other benthic organisms.

It should be noted that past occurrences of oil spills flushing to Belle Isle Inlet have shown that in 5 to 8 years, the Inlet will be recolonized (e.g., clams may reach legal size in 5 to 8 years). Evidence of the Inlet's recovery capacity is shown by the fact that legal size clams were found near the tide gate structure, which has been subjected to past oil spills.

Therefore, although even with the best of precautions the contaminants may unavoidably adversely affect the Inlet, the impacts should not be irreversible. In addition, these temporary impacts will probably affect

no more than the upper third of the Belle Isle Inlet.

2. Wildlife

Due to the eliminating of reed grass along the open waterways (to prevent clogging), the number of birds (i.e., red-winged blackbird) utilizing the Phragmites for nesting will be reduced.

ADDENDUM TO PRELIMINARY DRAFT ENVIRONMENTAL IMPACT REPORT

SALES CREEK, REVERE

The following outlines Camp Dresser & McKee's response to the Department of Environmental Quality Engineering's (DEQE) letter dated January 19, 1977 with regard to the DEQE's internal review of the above mentioned report. A copy of this letter is included as part of the addendum.

ITEM 1. A paragraph will be added on page II-72 just before Item 5 "Economic Base Characteristics". The following will be inserted: "Chapter 91 and Chapter 347 of 1976 Massachusetts General Laws. The Division of Waterways will not be required to issue licenses under Chapter 91 or Chapter 347 of the 1976 Massachusetts General Laws because the Division is responsible for administering the design and construction of the project and the Division does not have to obtain licenses for its own projects."

ITEM 2. Section IIA1b, page II-4 will be amended as follows: After the fourth paragraph on this page insert the following paragraph: "On June 5, 1895, a Harbor and Land License Number 1783 was issued to Edward Turner of Quincy and Costello C. Converse of Malden, Trustees of the Boston Land Company. This license granted the filling of an area in the vicinity of Saratoga Street where it crossed the Belle Isle Inlet, and also an area near the Boston and Maine Railroad where it crossed Sales Creek. In addition to allowing the filling of these areas, the license stipulated that tide gates and culverts would be required."

ITEM 3. Section IIA5g page II-28 shall be amended as follows: After the first paragraph on this page insert the following paragraph:

"On November 6, 1962, the Department of Public Works granted a license to the Eastern Racing Association, Inc. for the con- construction of a 66-inch culvert and drop inlet manhole in the vicinity of the Lee Burbank Highway near Orient Heights, East Boston."

ITEM 4. Section VB1b will be amended as follows: After the last sentence in the second paragraph on page V-7 add the following sentence:

"Disposal of the contaminated sediments anywhere in Massachuchusetts would require the approval of the Massachusetts Division of Water Pollution Control, DEQE."

Add the following paragraph on page V-12, after the second paragraph on this page:

"Upon reviewing the proposed on-site disposal technique, the Division of Water Pollution Control indicated that the site to be selected should have one foot of compacted clay as a liner on both the bottom of the excavation and a final cover on the top of the excavation after the contaminated material has been placed there. This will minimize the possibility of contaminants leaching to the creek. This would probably increase the area required for the pit, but there appears to be sufficient land available. In addition, inspection by the Division of Water Pollution Control will be required for the following activities relative to on-site disposal of the dredged material:

a. site selection

b. after excavation is made

c. after the one foot of clay as a liner is placed and compacted

d. after the contaminated material has been placed in the excavation

e. after the clay final cover is placed and compacted and,

f. after the fill material is placed on the clay cover with sufficient slope to prevent surface water from eroding."

ITEM 5. Section IIA6d, Page II-37 will be amended as follows: Under "Non-Point Sources" after the last sentence, add the following sentences: "Apparently, much of the "tank farm" area is served by sub-surface sewage disposal. Over a period of time this could be a non-point source of pollution in the Creek."

ITEM 6. Section VB1a, will be amended as follows: After the second paragraph on page V-5 the following will be inserted: "In addition to haybales, oil booms and absorbent booms for control of oil pollution can be utilized at two locations: at the culvert between reach 1 and reach 5a (entrance to Suffolk Downs), and at the inlet from Sales Creek to Belle Isle Inlet. Absorbent booms will provide better oil control than will the haybales, but their ability to reduce suspended solids is not known. Accordingly, it is advisable to use the haybales at the infield section of Suffolk Downs to control the suspended solids."

ITEM 7. Section IIA6a will be amended as follows: The last sentence in the first paragraph on Page II-23 will be eliminated and replaced with the following:

"The mercury levels were below the 0.01 milligrams per liter (mg/l) recommended limit (Water Quality Criteria, National Academy of Sciences, Washington, DC, EPA, R3.73.033, March 1973) at sample stations 1 to 4. Water at the Bennington Street tide gate station contained mercury at 0.018 mg/l and water at the Belle Isle Inlet Station contained 0.019 mg/l of mercury."

ITEM 8. Section IVA2a will be amended as follows: after the last sentence in this section on Page IV-3 add the following:

"It might be stated that the diversion of Sales Creek drainage to the Chelsea Creek would have the beneficial impact of possibly allowing the harvesting of shellfish in the Belle Isle Inlet. However, at present, there are some combined sewer discharges into the Belle Isle Inlet downstream of the study area. This is the present major source of pollution and the major deterrent to harvesting. As far as long range planning towards improved cleaning of the Inlet is concerned, the diversion to Chelsea Creek does have merit."

ITEM 9. Section VB1b, Page V-12 will be amended as follows: after the first sentence in the second paragraph add the following:

"The vegetation surrounding the proposed spoil burial site is typical of disturbed areas and offers very little in the way of wildlife potential. The grasses and weeds found in the area are very tolerant and except for the loss of unimportant vegetation at the burial site itself, no impact is expected to the surrounding

vegetation and land."

The remaining part of the existing paragraph on page V-12 will be eliminated.

ITEM 10. The exact boundry of a 25 year flood is not known at the present time, and probably will not be known until the Revere and Boston Flood Insurance studies have been completed. It should be pointed out that to try to define the 25 year flood in this study is well beyond the scope of work, and would be a rather time consuming task.

In Section IIA3 the following paragraph will be added on page II-13 after the second paragraph:

"As noted previously, Fig. 6 outlines areas reported to be subjected to flooding and also delineates the preliminary 100 year flood boundary. As will be noted in a later section in this chapter both Revere and Boston are presently having Flood Insurance Studies conducted. When these studies are completed a delineation of the area which would be effected by a 25 year storm may be available."

ITEM 11. Section VC1 page V-16 will be amended as follows: After the first paragraph on this page, add the following paragraph:

"In order to insure that proper maintenance procedures are carried out, it is suggested that the state meet with the cities of Revere and Boston and develop a satisfactory maintenance agreement."

ITEM 12. The primary purpose of this Environmental Impact Report (EIR) is concerned with the proposed construction of flood relief facilities as opposed to pollutional control. Where possible the pollutional aspects of the project and the contributing drainage area such as

past oil spills from the petroleum "tank farm" (which we understand, has been corrected) have been identified. Treatment of stormwater runoff prior to discharge to the inlet would not be cost effective when compared with benefits which would be gained by the eventual elimination of combined sewer overflows into the inlet. However, the operation of the proposed pumping station will provide some measure of pollution control in the inlet and the following paragraph will be added after the first paragraph on page III-4 (Section IIIA3d):

"Operation of the pumping station and open canal system will have a direct beneficial impact on the water quality in Belle Isle Inlet since these facilities will act to a certain extent as detention basins for the removal of solids transported by stormwater conduits and overland flow. These solids should be periodically removed by dredging when they accumulate.

Rec'd 1/?/ 26 ?

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

Department of Environmental Quality Engineering

100 Cambridge Street, Boston 02202

DAVID STANDLEY
COMMISSIONER

January 19, 1977

Mr. Thomas F. Cheyer
Camp, Dresser and McKee, Inc.
One Center Plaza
Boston, Massachusetts 02108

Re: Preliminary Draft Environmental Impact Report, Sales Creek, Revere

Dear Mr. Cheyer:

The Department of Environmental Quality Engineering (DEQE), with the assistance of the Coastal Zone Management, has reviewed the preliminary version of the proposed Sales Creek Flood Control project.

The purpose of the review was to determine whether the EIR could be submitted by the DEQE to the Secretary of Environmental Affairs for formal review as a Draft EIR.

As indicated in the comments which follow, the DEQE recommends several additions and/or corrections to the EIR before formal submission.

COMMENTS

1. The EIR is being prepared by Camp, Dresser, and McKee under contract to the DEQE, Division of Land and Water Use (Waterways). The Division will not be required to issue licenses under chapter 91 or chapter 347 of 1976 of the Massachusetts General Laws for its own project. The Division will, however, be responsible for administering the design and construction of the proposed project, should the EIR be approved by the Secretary of Environmental Affairs.

It is suggested that in order to inform the general public that Waterways licenses will not be necessary, a statement of this fact be included in the EIR in Section II C. 4.e., page II-67.

2. Section II A.1.b., page II-4 should be amended to reflect the issuance of an additional license: Harbor and Land license #1783, dated June 5,1895.

3. Section II A.5.g., page II-27 should be amended to reflect the issuance of an additional license: D.P.W. license #4365, dated November 6, 1962.

4. The disposal of the dredged material is, in part, hazardous waste and will require proper disposal in an approved site. The EIR should state that since there are currently no sites in Massachusetts, an alternate site must meet with the approval of the Division of Water Pollution Control, DEQE.

The site to be selected should have 1 foot of compacted clay as a liner on both the bottom of the excavation and a final cover on top of the excavation after the contaminated material has been placed there. This will require inspection by the Division of Water Pollution Control of the following activities:

a) site selection
b) after excavation is made
c) after the 1 foot of clay as a liner is placed and compacted
d) after the contaminated material is placed in the excavation
e) after the clay final cover is placed and compacted
f) after the fill material is placed on the clay cover with sufficient slope to prevent surface water from eroding.

These functions of the Division of Water Pollution Control should be included in the EIR.

5. The high bacterial counts recorded and mentioned in the preliminary EIR may be attributed to subsurface sewage disposal systems since there are no municipal sewers in the area. The "tank farm" area is sewered by subsurface disposal.

It is suggested that the EIR make note of this matter.

6. The dredging of the Sales Creek area will not only resuspend silt but will also cause a constant "rainbow" from the oil saturated stream bed and adjoining banks. It is recommended that oil containment booms and absorbents be used throughout the dredging process and that the EIR include a discussion of these measures.

7. Page II-33 contains a statement that "Mercury levels were below 0.5 mg/1 allowable limit." The EIR should include a reference to the appropriate agency's standard.

8. If Sales Creek were diverted to Chelsea Creek, would it then be possible to harvest some of the shellfish from Belle Isle Creek whose resource might translate to $190,000 (see page II-49 of the preliminary EIR)?

9. It is suggested that the measures to be considered and/or employed to minimize leaching and other potential adverse affects be expanded. For example, the disposal of the spoils on-site appears to have the potential for affecting several acres of adjacent land. The extent and nature of these impacts, if any, should be thoroughly discussed in the EIR.

10. The preliminary EIR appears to describe project design for a 25-year storm Maps included in the preliminary EIR show potential impacts for a 100-year flood. It is suggested that the maps make it clear what areas would be impacted by a 25-year storm.

11. It is suggested that the EIR mention what measures can be expected to be employed by state and/or local authorities for insuring that future trash disposal in the area will not reoccur following the proposed project's completion.

12. From the preliminary EIR, it appears that the project's design does not include facilities for treatment of stormwater runoff prior to discharge. It is suggested that the EIR address the measures that would be necessary for treatment of stormwater runoff and an explanation of why such measures have not been included as part of the design of the Sales Creek Flood Control project.

SUBMITTAL OF AN ACCEPTABLE DRAFT EIR BY DEQE

When the above listed comments have been satisfactorily addressed, a Draft EIR will be formally submitted to the Secretary of Environmental Affairs in compliance with the Massachusetts Environmental Policy Act of 1972 (MEPA).

When the comments have been addressed and a Draft EIR is prepared, it is suggested that the DEQE be notified so that formal submission procedures can begin. Contact Mr. Richard Bates, Environmental Review Analyst, DEQE, at 727-7436 when the Draft EIR is prepared. Should you have any questions, please contact Mr. Bates.

Sincerely,

David Standley

David Standley
Commissioner

DS/RB/ls

cc: John J. Hannon, Division of Land and Water Use
Ed MacDonald, Division of Land and Water Use
George Sheehan, Division of Land and Water Use
Thomas McMahon, Division of Water Pollution Control
Sabin Lord, Division of Water Pollution Control
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